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ABSTRACT

This report provides a survey and evaluation of chemical information literature. Contained in this survey are an overview of the chemical literature field, comments on obtaining access to this literature and annotated bibliographies of primary, secondary, and tertiary sources as well as special topics. Primary sources include journals, patents, dissertations, conferences, and reports. Secondary literature includes dictionaries, encyclopedias, handbooks, data sources, methods, monographs, multigraphs, serials, treatises, reviews, bibliographic guides, abstracting services and alerting services. Tertiary literature is defined as textbook guides. Special topics include nomenclature, biographies, directories, safety, environmental, marketing and business. (CW)

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CHEMICAL INFORMATION: PRINT

Directed Study

Catherine C. Stone
State University of New York at Buffalo
Fall, 1987

SE 049 011

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Directed Study in Chemical Literature

Course Objectives

1. Provide familiarity with the broad area of chemical information in printed sources.
2. Develop detailed knowledge of selected sources in chemical information.
3. Develop skill in the use of selected sources to find chemical information.

Course Materials

Texts

Maizell, Robert E. How to Find Chemical Information: A Guide for Practicing Chemists, Educators, and Students. 2nd ed. New York: John Wiley & Son, 1987.

Woodburn, Henry M. Using the Chemical Literature: A Practical Guide. New York: Marcel Dekker, 1974.

Classroom Materials

"Introduction to Chemical Literature", undergraduate course Chem 376, SUNY at Buffalo, Mrs. Priscilla B. Clarke, instructor.

"Chemical Documentation", graduate course C 400, Chemical Information Specialist Program, Indiana University School of Library and Information Science, Mr. Gary Wiggins, instructor, developer.[1]

Course Scope

The course outline is based on the texts recommended for the courses named above. The material kindly provided by Mrs. Clarke and Mr. Wiggins include lists of reference sources and lecture handouts which will be used to supplement the texts. Further information will be sought, as appropriate, in other guides to the literature and journal articles.

The course will not include information on:
Government sources-covered in LIS 567;
Online sources-introduced in LIS 566, continued in future;
Technical writing-covered by course work prior to graduate school.

Course Activities

For each section in the outline the texts and other appropriate material will be read. The reference sources will be studied using the resources of the Chemistry Libraries at the University of Rochester and SUNY/Buffalo. The homework assignments for Chem 376 will be completed. A brief summary of the knowledge acquired and bibliography of sources covered will be submitted.

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[1] Wiggins, Gary. "The Indiana University Chemical Information Specialist Program: Training the Library User and the Librarian." Science & Technology Libraries 1 (1981): 5-11.

Directed Study in Chemical Literature

Course Outline

	Text Chapters Maizell	Woodburn
I. Introduction		
A. Overview	1-3,19	1,2
B. Access	4-5,19	16
II. Tertiary Literature		
Textbook Guides		
III. Secondary Literature - Organized		
A. Bibliographic Guides		
B. Chemical Abstracts	6-7	12-13
C. Other Abstracting Services	8	11,13
D. Alerting Services		14
IV. Secondary Literature - Evaluated		
A. Dictionaries, Encyclopedias	12	
B. Handbooks, Data Sources, Methods	12,15,18	6-10
C. Monographs, Multigraphs, Serials,		4
D. Treatises, Reviews	11	4
V. Primary Literature		
A. Journals	4	
B. Patents	13	17
C. Dissertations	4	
D. Conferences	4	
E. Reports		
VI. Special Topics		
A. Nomenclature		5
B. Biographies, Directories		
C. Safety, Environmental	14	
D. Marketing, Business	16-17	

I. Introduction
A. Overview of Field

An overview of the field of chemical literature was useful in planning this directed study. Introductory chapters in the texts, materials from the university courses, and information from supplementary guides to chemical literature were consulted.

Knowledge of chemical information is important to chemists to avoid duplication of reported work saving time, money, and infringement problems and to aid in creatively planning future research based on a foundation of background data. Information is needed on physical data, processes, uniqueness of ideas, logic of concepts, mechanisms of reactions, correlation of structure to physical properties, and the relation of structure and physiological behavior. Despite the increasing importance of computer readable sources of chemical information, knowledge of information in printed form remains important in its own right, as a basis for understanding the content of computerized information, as a continuing resource in the absence of computer access, and as a primary form of retrospective searching.

The efforts of chemists may be supplemented by information specialists who have the training required by the complexity, number, and importance of rapidly changing information sources. Working together they may develop appropriate search strategies at the various stages in the information flow. The specialist's role is predicted to continue increasing though at a declining rate as the increasing complexity of information is combated by improvements in tools and use of microcomputers.

Both databases and journals continue to proliferate, although the growth rate of the former is greater. Contrary to claims of an information explosion, the rate of growth in chemical literature has declined during the 1970s and 80s. Although Japanese publications are continuing to increase, American publications have stabilized, and those from Great Britain and the U.S.S.R. have declined. The English language has increased its dominance in chemical literature as in all of science. Russian holds a distant second place in the percentage of publications followed by Japanese. German continues to be important for retrospective searching.

Retrieving information requires knowledge of the structure of chemistry, the central science. Although traditionally divided into the five sub-disciplines of inorganic, organic, analytical, physical, and biochemistry, there are two major areas which cross discipline boundaries: constitutional chemistry and reaction chemistry. Constitutional chemistry investigates the chemical nature of matter through structural investigation of the types of atoms in pure substances, their spatial arrangements and bond types, and through analysis of mixtures. Reaction chemistry studies the mechanism of producing new substances from materials and energy.

The printed literature of chemistry is traditionally divided into primary, secondary, and tertiary sources with some overlap of the divisions and some disagreement on their content. The primary literature is generally accepted as

the researcher's archival record of chemistry including journal articles, conference proceedings, government reports, technical reports, dissertations, theses, and patents. A wide variety of fugitive forms of literature may also be included. Secondary literature includes the books or serials which collect and organize the information in primary publications for effective retrieval with or without evaluation. Examples include: indexes, abstracts, bibliographies, treatises, texts, monographs, multigraphs, encyclopedias, dictionaries, handbooks, and reviews. The tertiary literature, considered by some to be the evaluated forms of the secondary literature, will be considered here in the broader tradition of works which teach the extent and use of the primary and secondary literature and guide users to those sources.

I. Introduction
B. Access

Recent improvements to access of chemical information have been stimulated by computer technology but are evident in printed literature as well. Development of alerting services, new and repackaged information products to meet specific needs, and substantial improvements in the time required for publication of primary and secondary sources have all improved access for users of chemical information. Document delivery services supplement access provided by libraries. Each publication format has specific aids to access.

Journal access is aided by local and national union lists and the international bibliographic and holdings information in Chemical Abstracts Service Source Index (CASSI). Access to books not available locally is aided by the National Union Catalog; Scientific and Technical Books and Serials in Print; New Books in Chemistry, a CAS bulletin; and Cumulative Book Index. Patents may be accessed through use of articles about them, equivalent patents, depository libraries, the U.S. Patent Office, CASSI, CAS Document Delivery Service, and such private organizations such as Derwent or Plenum. Reports are available through the National Technical Information Service (NTIS). Specifications and standards may be obtained from the American Society for Testing and Materials (ASTM), the American National Standards Institute (ANSI), or through Information Handling Services. Theses and Dissertations may be located through Master Abstracts, Master Theses in Pure and Applied Science, Dissertation Abstracts International B. Science and Engineering, or Comprehensive Dissertation Index. Proceedings may be located through CASSI, Index of Conference Proceedings Received, Directory of Published Proceedings, or Index to Scientific and Technical Proceedings.

The need for translations has declined in the U.S. as the percentage of articles written in English approaches 70%. Many foreign journals are translated into English cover-to-cover when published and may be located through CASSI. Options for items written in foreign languages include the use of equivalent English articles or abstracts, use of review articles or books, commercial translation services, continuing lists of translations available in libraries, and translation indexes such as Translations Register Index or World Index of Scientific Translations.

II. Tertiary Literature
Teaching Guides

Publications termed guides are of two types. Guides which provide bibliographies of chemical publications with or without annotation constitute reference tools organizing literature and will be considered with the secondary literature of chemistry. Reviewed here are teaching guides which provide a command of the chemical literature through instruction on types of sources available and use of specific references tools in addition to bibliographic descriptions of specific sources.

Textbook guides concentrating on the discipline of chemistry are useful for specific guidance in the chemical literature and for the large number of chemical references included. Guides covering the spectrum of scientific and technical disciplines present more general instruction with only major references sources listed in each field. They are useful as starting points and for cross disciplinary studies.

The most common format for teaching guides is the monograph or multigraph. Encyclopedia articles contain general information useful as a starting point. Journal articles present more current information but are generally dedicated to a sub-discipline or smaller field of interest. Journals specializing in the field include: the Journal of Chemical Information and Computer Science (formerly Journal of Chemical Documentation), the Chemical Information Bulletin from the American Chemical Society (ACS) Division of Chemical Information, and the Journal of the American Society of Information Science. Less common formats include AV presentations and conference proceedings Instructions also accompany secondary literature sources.

Note on Bibliographies for Directed Study

The annotated bibliographies submitted for the primary, secondary, and tertiary sources of chemical information will include only recommended sources actually located and studied. They are not intended to be complete guides to the chemical literature, nor will they function as footnotes to the brief summaries written in support of the work done in this directed study. A final bibliography will include all the reference sources used in the directed study.

In order to obtain familiarity with and practice in the use of the citation style recommended by the ACS for chemical writing, it will be employed for these bibliographies. There are two important variations from the bibliographic format commonly used for papers written in non-scientific fields. First, the factual nature of scientific writing and the importance of documenting facts leads to a fusion of the footnote/endnote documentation with the final bibliography in a combination of their traditional forms. Second, the interest in specific details rather than general information in research reports and the footnote nature of their bibliographies has led to a form of abbreviated journal article citations which includes the details necessary to lead the reader to the article but eliminates the article title. In consideration of the purpose of these bibliographies, article titles will be included parenthetically at the end of their citations.

Bibliography
Tertiary Literature

Gould, R. F. Literature in Chemical Technology: American Chemical Society: Washington, DC, 1968.

A symposium of experts present information on finding literature in 40 sub-disciplines of chemical technology. Extensive bibliographies included.

Graham, M. H.; Lamy, A. B.; Lawrence, B.; Stroumtsos, L. Y. In Encyclopedia of Chemical Technology: Grayson, M., Ed.; John Wiley & Sons: New York, 1981; 13, 278-336. (Information Retrieval)

Presents a general discussion of print and online sources for chemical information including developments, access, and some information sources.

Grogan, D. Science and Technology: An Introduction to the Literature: Clive Bingley: London, 1982.

This student textbook gives instruction in finding and using all forms of scientific and technical literature. Examples are presented within the discussion rather than in bibliographies. British slant.

Maizell, R. E. How to Find Chemical Information: A Guide For Practicing Chemists, Educators and Students: John Wiley & Sons: New York, 1987.

A textbook which provides information for chemists and information professionals on print and online chemical information. Includes coverage of basics on literature, communication, and searching; details on the use of specific publications; and information on special topics of industrial importance.

Malinowsky, H. R.; Richardson, J. M. Science and Engineering Literature: A Guide to Reference Sources: Libraries Unlimited: Littleton, CO, 1980.

A systematic examination of the disciplines of science and engineering presenting annotated bibliographies for each by literature form. This compromise of textbook and bibliographic guide includes general descriptions of literary forms and annotated bibliographies of multidisciplinary sources of information.

Mellon, M. G. Chemical Publications: Their Nature and Use: McGraw-Hill Book: New York, 1982.

Beginning with the history of chemical literature, this textbook uses a classical division of literature sources in presenting general information, guides to the use of specific publications, and extensive bibliographies for each format. The second part of the book includes library problems, writing aids, and information on manual and online searching.

Parker, C. C.; Thurley, R. V. Information Sources in Science and Technology: A Practical Guide to Traditional and Online Use: Butterworths: London, 1986.

A practical search reference and how-to tool for librarians and library students with a British slant. This guide to guides presents instruction on finding information in science and technology and exposition of literature forms with examples of guides for each. Covers online and print sources. Includes instructive charts, searching directions, and information on organizations and people.

Schenk, M. T.; Webster, J. K. What Every Engineer Should Know About Engineering Information Resources: Marcel Dekker: New York, 1984.

Chapters include instruction, information, and selected examples of all forms of literature for engineering and subfields including chemical engineering. Covers societies, translations, and license review.

Skolnik, H. The Literature Matrix of Chemistry: John Wiley & Sons: New York, 1982.

Presents instruction, information and annotated examples for all literature forms. Emphasises role of literature in the progress of chemistry.

Subramanyam, K. In Encyclopedia of Library and Information Science: Kent, A; Lancour, H.; Daily, J. E., Eds.; Marcel Dekker: New York, 1979; 26, 376-548. (Scientific Literature)

A condensed version of the 1981 book, Scientific and Technical Information Resources, below.

Subramanyam, K. Scientific and Technical Information Resources: Marcel Dekker: New York, 1981.

A comprehensive textbook covering science and technology with explanatory information on all formats. Includes comprehensive bibliographies for each format divided by disciplines; a glossary of acronyms; and general information on communications, societies, and trends.

Use of Chemical Literature: Information Sources for Research and Development; Bottle, R. T., Ed.; Butterworths: Boston, 1979.

A British multigraph serving as both textbook and bibliographic guide. General presentations on sources according to format are supplement by sections on sources specific to the subdisciplines of chemistry. Includes nomenclature information and library problems/solutions. Dated.

Wolman, Y. Chemical Information: A Practical Guide to Utilization: John Wiley & Sons: New York, 1983

A practical approach to specific sources in chemical literature oriented toward problem solving and numerical data. Contains glossary of acronyms. Limited bibliographies.

Woodburn, H. M. Using the Chemical Literature: A Practical Guide: Marcel Dekker, Inc.: New York, 1974.

A textbook of literature use limited to discussion of problem areas. Includes a chapter on numenclature and a glossary of acronyms. Dated.

III. Secondary Literature
A. Bibliographic Guides

Bibliographic guides serve as organized subject access tools to the literature of a single field, or a broad range of interests. They list information sources such as books, periodicals, journal articles, reports or conference papers. Annotations may be included with the references.

Bibliographic coverage varies with respect to subject scope, document coverage,and time period. Some general bibliographies include sections on scientific works. Scientific and technical bibliographies are generally divided according to discipline and have a chemistry section. More specific to the field of chemistry are bibliographic guides to the field itself, those relating to the sub-divisions of chemistry, and partial or comprehensive or bibliographies on specialized topics.

Current bibliographies include recent publications and provide current awareness service as well as contributing to literature surveys. These current guides are usually serials and include forms such as acquisition lists for libraries; reviews and announcements in journals; the annotations, abstracts or book reviews in abstracting and indexing services; trade bibliographies; and reviews of reference tools.

Retrospective bibliographies, valuable in comprehensive literature surveys, describe material published in the recent or distant past in books or annual cumulations of serial bibliographies. Indexes are generally included to complement the main arrangement of the works.

Bibliographies of bibliographies constitute a tertiary form of literature that provides access to the bibliographic guides available in subjects and aid in finding hidden bibliographies which appear as parts of other documents such as books, articles, dissertations, technical reports, and reviews.

Bibliography
Secondary Literature
Bibliographic Guides

Antony, A. Guide to Basic Information Sources in Chemistry; John Wiley & Sons: New York, 1979.

Presents annotated bibliographies of chemical sources for all types literature. Features searching case studies. Dated.

Besterman, T. A World Bibliography of Bibliographies; Societas Bibliographica: Lusanne, Switzerland, 1965-1966.

A five volume set of 17,000 separtely published international bibliographies from the 15 century to 1963 arranged alphabetically by narrow subject headings. Continued in A World Bibliography of Bibliographies, 1964-1974 by A. F. Tooney.

Bibliographic Index: A Cumulative Bibliography of Bibliographies; H. W. Wilson: New York, 1937- .

Current and retrospective source of subject arranged bibliographies from separately published books or pamphlets and articles in 2200 international periodicals. Triannual with annual cumulations. Emphasis on American sources.

Bolton, H. C. A Select Bibliography of Chemistry 1492-1892; Smithsonian Institution: Washington, DC, 1893.

Retrospective bibliography covering principle books published in the United States and Europe from the first appearance of chemical literature to the close of 1892. Citations of foreign titles are not translated. One sentence annotations included. Supplements extend the basic work to 1902 and a second volume presents dissertations for the period.

Chen, C. C. Scientific and Technical Information Sources; MIT Press: Cambridge, MS, 1987.

Bibliographic guide giving comprehensive coverage of all literature forms for all science and engineering fields based on specified review sources. Coverage within each field is good but not comprehensive. Includes limited annotation.

Cumulative Book Index; H. W. Wilson: New York, 1898- .
Monthly trade bibliography of books in English listed by author, subject, and title in a single alphabet. Annual and five year cumulations.

Herner Saul. A Brief Guide to Sources of Scientific and Technical Information; Information Resources Press: Arlington, VA, 1980.

A selective annotated bibliography of print and online secondary and tertiary sources aimed at current and retrospective information for scientists working in research and development. Includes annotated lists of libraries and resource collections by national regions and advice to scientists on organization of information.

Library of Congress Catalogs: National Union Catalog; Library of Congress: Washington, DC, 1983- .

Microfiche offering author, subject, and title approaches to holdings of the LIbrary of Congress and 1100 libraries in the United States and Canada. Current information and cumulation of information from The National Union Catalog: A Cumulative Author List 1956-1982 and Library of Congress Catalogs: A Subject Catalog 1950-1982.

Peck, T. P. Chemical Industries Information Sources; Gale Research: Detroit, MI, 1979.

Annotated bibliographies by literatures forms for subdisciplines of chemical engineering. Includes comprehensive annotated directory of associctions for subdisciplines, annotated list of major U.S. libraries, and list of publishers addresses.

Scientific and Technical Books and Serials in Print: An Index to Literature in Science and Technology; R. R. Bowker: New York, 1987.

A comprehensive selection of current bibliographic and ordering information for in-print titles of hard and soft-bound books and serials published or distributed exclusively in the United States. The three volume set offers access by subject headings, author, and title.

Sheehy, E. P. Guide to Reference Books; American Library Association: Chicago, 1976.

An annotated guide to scholarly and popular reference tools divided into five broad subject sections. The section on pure and applied science is divided into smaller subject categories and subdivided by form. Index includes subject, author and title.

Walford, A. J. Guide to Reference Material Volume 1: Science and Technology; The Library Association: London, 1980.

An annotated guide to international books and serials classified according to discipline and subdivided by literature form. Contains subject index.

III. Secondary Literature
B. Chemical Abstracts

The products published by Chemical Abstracts Services (CAS) provide comprehensive access to the chemical literature of the world. Since its inception in 1907 as a division of the American Chemical Society, CAS has grown with the field of chemistry, improved with changes from volunteers to over 1,200 full time staff members, and taken advantage of advances in technology. The development in CAS products is of historical interest and an important element in retrospective searching. (See Tables 1 and 2.)

Currently CAS provides weekly abstracts, six indexes to the abstracts, reference tools to aid users in searching chemical literature, current awareness products, cooperative activities with other A & I services, and the Registry System for the unique identification of chemical compounds. The 8,500 weekly abstracts cover all scientific and technical papers containing new information of chemical or chemical engineering interest contained in 14,000 periodicals from 150 nations. Also included are patents from 26 countries and two international organizations, reviews, technical reports, monographs, conference proceedings, symposia, dissertations, and books.

The findings-oriented abstracts are written in a concise, informative format which provide major disclosures but are not a substitute for the original document. Publication occurs within 3 months of original publication with about half of the sections published each week and bound in a semiannual volume. The sequentially numbered abstracts are classified in 80 broad subject areas (Table 3), each subdivided into three literature categories which place new book announcements and patents after other documents types.

The weekly issues contain three indexes to their contents: author, patent and keyword. Currently there are six semiannual indexes to the abstracts each cumulated every five years: Author, General Subject, Chemical Substance, Ring Systems, Formula, and Patent. (See Table 4.)

The nomenclature used in CA has developed over the years according to usage changes in the field. In 1971 CA introduced the use of systematic nomenclature based on IUPAC (International Union of Pure and Applied Chemistry) rules. The Index Guide provides cross references from trivial names to systematic names used in the indexes as well as presenting indexing policy notes and information on general subject headings and subject cross-references.

Due to the depth and complexity of coverage, several other tools are provided for the user.

Registry Handbook-Number Section and its cumulated supplements provide access to the index of compounds from registry numbers.

Registry Handbook-Common Names is a microform companion providing access to the compound index from non-systematic names.

Ring Systems Handbook contains access information for ring and cage systems.

Subject Coverage and Arrangement of Abstracts by Sections in Chemical Abstracts is a subject coverage manual useful in locating abstract sections.

Chemical Abstracts Service Source Index (CASSI) contains bibliographic and holdings information for the documents abstracted in CA.

CA Section Groupings are five complete reproductions of groups of subject related sections of CA aimed at reducing its size and price for individuals interested in the broad areas of biochemistry, organic chemistry, macromolecular chemistry, applied chemistry/chemical engineering, or physical/analytical chemistry.

Current awareness products include CA Selects, Chemical Titles, Chemical Industry Notes, and CA Chemissues (microfiche).

	Collective Index										
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
Years	1907–1916	1917–1926	1927–1936	1937–1946	1947–1956	1957–1961	1962–1966	1967–1971	1972–1976	1977–1981	1982–1986
CA volumes	1–10	11–20	21–30	31–40	41–50	51–55	56–65	66–75	76–85	86–95	96–105
Author Index	×	×	×	×	×	×	×	×	×	×	×
Subject Index	×	×	×	×	×	×	×	×			
Index Guide								×	×	×	×
Chemical Substance Index									×	×	×
General Subject Index									×	×	×
Formula Index		*b*	*b*	*b*	×	×	×	×	×	×	×
Index of Ring Systems	*a*	*a*	*a*	*a*	*a*	*a*	×	×	×	×	×
Numerical Patent Index				*b*	×	×	×	×	×		
Patent Concordance							×	×	×		
Patent Index										×	×

[a]For the 1st through the 6th Collective Indexes, Ring System Information was included in the Introduction to the *Subject Index;* for the 7th through the 11th Collective Indexes, the *Index of Ring Systems* was bound with the *Formula Index.*

[b]Two special Collective Indexes are available for searches of patents and formulas: The *10-Year Numerical Patent Index to Chemical Abstracts* (1937–1946) and the *27-Year Collective Formula Index to Chemical Abstracts* (1920–1946).

Table 1: CA Collective Indexes Historical Development

Maizell, R. E. How to Find Chemical Information: A Guide for Practicing Chemists, Educators, and Students; John Wiley & Sons: New York, 1987, p. 63.

Chemical Abstracts Service Information System

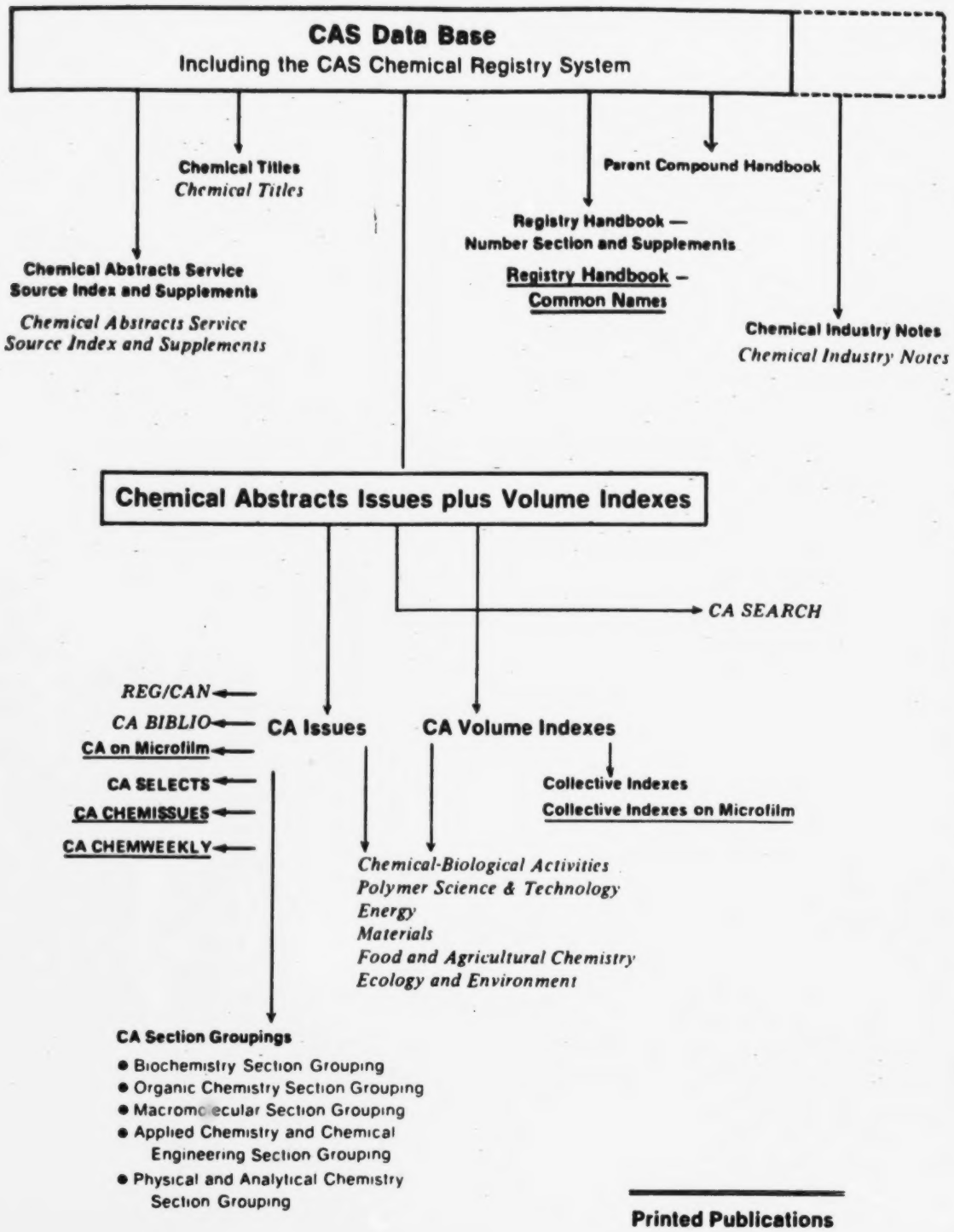

Table 2: Chemical Abstracts Service
CAS Printed Access Tools: A Workbook;
American Chemical Society: Washington, DC,
1981, p. 19.

CA SECTIONS

Based on its subject, each CA abstracts is assigned to one of 80 sections and is printed only once. The CA Section titles are:

Biochemistry Sections

1. Pharmacodynamics
2. Hormone Pharmacology
3. Biochemical Interactions
4. Toxicology
5. Agrochemicals
6. General Biochemistry
7. Enzymes
8. Radiation Biochemistry
9. Biochemical Methods
10. Microbial Biochemistry
11. Plant Biochemistry
12. Nonmammalian Biochemistry
13. Mammalian Biochemistry
14. Mammalian Pathological Biochemistry
15. Immunochemistry
16. Fermentations
17. Foods
18. Animal Nutrition
19. Fertilizers, Soils, and Plant Nutrition
20. History, Education, and Documentation

Organic Chemistry Sections

21. General Organic Chemistry
22. Physical Organic Chemistry
23. Aliphatic Compounds
24. Alicyclic Compounds
25. Noncondensed Aromatic Compounds
26. Condensed Aromatic Compounds
27. Heterocyclic Compounds (One Hetero Atom)
28. Heterocyclic Compounds (More Than One Hetero Atom)
29. Organometallic and Organometalloidal Compounds
30. Terpenoids
31. Alkaloids
32. Steroids
33. Carbohydrates
34. Synthesis of Amino Acids, Peptides, and Proteins

Macromolecular Chemistry Sections

35. Synthetic High Polymers
36. Plastics Manufacture and Processing
37. Plastics Fabrication and Uses
38. Elastomers, Including Natural Rubber
39. Textiles
40. Dyes, Fluorescent Whitening Agents, and Photosensitizers
41. Leather and Related Materials
42. Coatings, Inks, and Related Products
43. Cellulose, Lignin, Paper and Other Wood Products
44. Industrial Carbohydrates
45. Fats and Waxes
46. Surface-Active Agents and Detergents

Applied Chemistry and Chemical Engineering Sections

47. Apparatus and Plant Equipment
48. Unit Operations and Processes
49. Industrial Inorganic Chemicals
50. Propellants and Explosives
51. Fossil Fuels, Derivatives and Related Products
52. Electrochemical, Radiational, and Thermal Energy Technology
53. Mineralogical and Geological Chemistry
54. Extractive Metallurgy
55. Ferrous Metals and Alloys
56. Nonferrous Metals and Alloys
57. Ceramics
58. Cement and Concrete Products
59. Air Pollution and Industrial Hygiene
60. Sewage and Wastes
61. Water
62. Essential Oils and Cosmetics
63. Pharmaceuticals
64. Pharmaceutical Analysis

Physical and Analytical Chemistry Sections

65. General Physical Chemistry
66. Surface Chemistry and Colloids
67. Catalysis and Reaction Kinetics
68. Phase Equilibriums, Chemical Equilibriums, and Solutions
69. Thermodynamics, Thermochemistry, and Thermal Properties
70. Nuclear Phenomena
71. Nuclear Technology
72. Electrochemistry
73. Spectra by Absorption, Emission, Reflection, or Magnetic Resonance, and Other Optical Properties
74. Radiation Chemistry, Photochemistry, and Photographic Processes
75. Crystallization and Crystal Structure
76. Electric Phenomena
77. Magnetic Phenomena
78. Inorganic Chemicals and Reactions
79. Inorganic Analytical Chemistry
80. Organic Analytical Chemistry

Table 3: CA Abstract Sections
CAS Printed Access Tools: A Workbook; American Chemical Society: Washington, DC, 1981, p. 298.

ACCESSING CA REFERENCES

The following chart with accompanying table represents a guide to accessing CA references based on six types of information with which searches are often begun. The CA abstract provides a reference to the original document, and the Chemical Abstracts Service Source Index supplies the location of libraries holding the document.

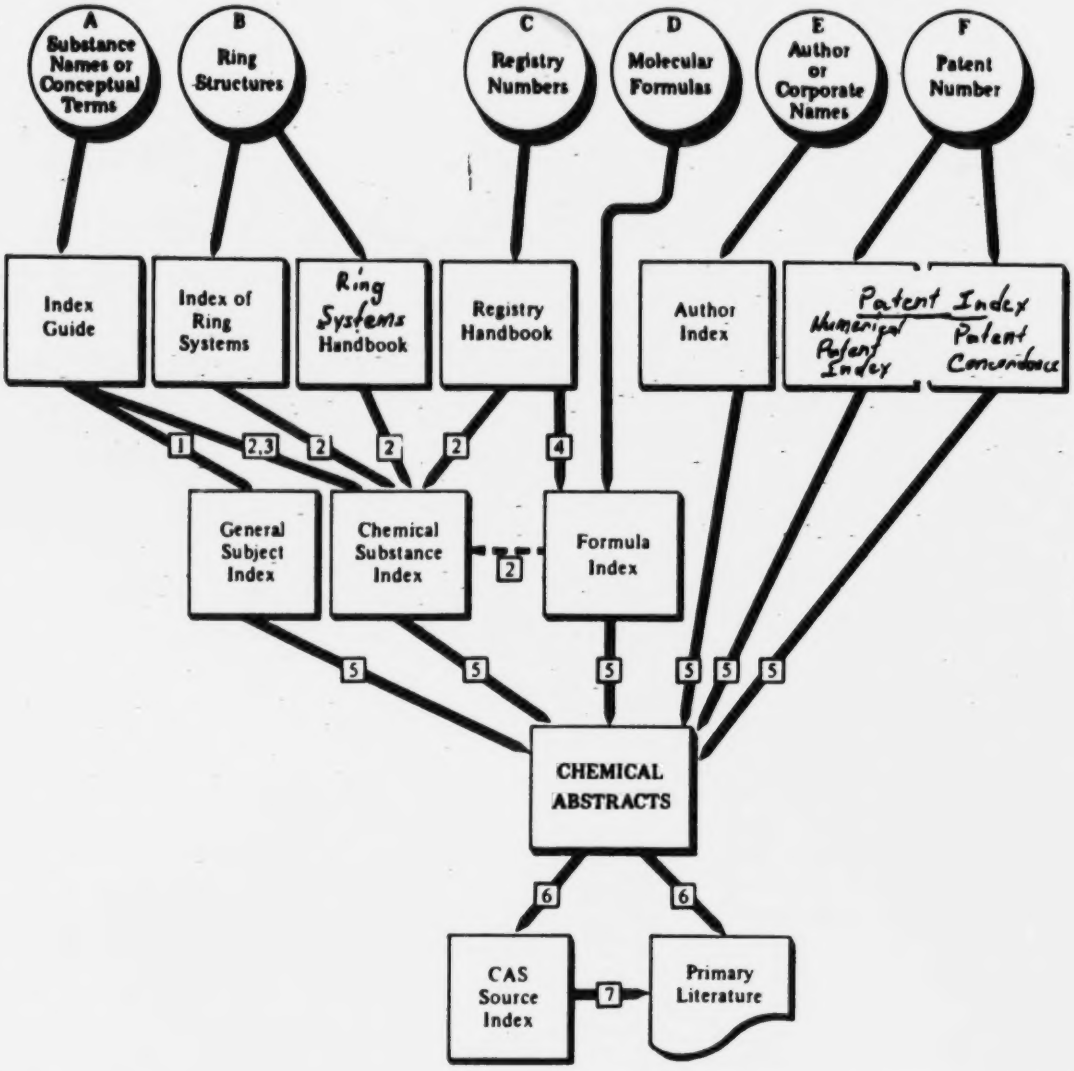

Table 3. Index access terms are designated by letters A-F. Numbers 1-7 refer to information retrieved:

1-General Subject Index headings
2-CA Index Name
3-CAS Registry Number
4-Molecular formula
5-CA abstract number
6-Bibliographic citation
7-Library holdings

Table 4: Accessing CA References
Adapted from CAS Printed Access Tools: A Workbook; American Chemical Society: Washington, DC, 1981, p. 20.

Bibliography
Secondary Literature
Chemical Abstracts

CAS Printed Access Tools: A Workbook; American Chemical Society, Chemical Abstracts Service Division: Washington, DC, 1981.

This CAS workbook serves as a practical teaching tool of illustrated problems and detailed solutions designed to aid efficient searching of Chemical Abstracts. It provides brief explanations of the CA print tools, sequence of approaches to them, and details on content of their entries.

Chemical Abstracts: Author Index; Chemical Abstracts Service: Columbus, OH, 1907- .

Provides access to abstract numbers and titles from an alphabetical listing of authors, corporate authors, patentees, and patent assignees. Semiannual issues are derived from weekly issues and are cumulated every five years.

Chemical Abstracts: Chemical Substance Index; Chemical Abstracts Service: Columbus, OH, 1907- .

Subject access to abstract numbers and CAS registry numbers from headings for specific elements or chemical compounds and their derivatives obtained from original documents. Selected cross-references. Semiannual issues are cumulated every five years.

Chemical Abstracts: Formula Index; Chemical Abstracts Service: Columbus, OH, 1920- .

Access to abstract numbers, systematic names, and CAS registry numbers from an alphabetical list of Hill system molecular formulas obtained from original documents. Cross references to the Chemical Substance Index. Semiannual issues are cumulated every five years.

Chemical Abstracts: General Subject Index; Chemical Abstracts Service: Columbus, OH, 1907- .

Gives general subject access from original documents to abstract numbers. Includes general compound categories but no specific chemical substances or cross references. The alphabetical list is subsequently classified by seven qualifiers (analysis, biological studies, occurrence, preparation, properties, reactions, and uses) and further subdivided by 15 categories of chemical functional groups. Semiannual issues are cumulated every five years.

Chemical Abstracts: Index Guide; Chemical Abstracts Service: Columbus, OH, 1968- .

User aid for Chemical Abstracts Indexes. Provides access from vague subject or trivial name to correct heading or name and registry number. Includes subject and chemical substance hierarchies and directions for use of all CA indexes. New edition every 18 months with five year cumulations.

Chemical Abstracts: Index of Ring Systems; Chemical Abstracts Service: Columbus, OH, 1916- .

User aid providing systematic names of ring parents and stereoparents found in original documents based on ring and elemental analyses. Semiannual issues are cumulated every five years.

Chemical Abstracts: Key to the World's Chemical Literature; Chemical Abstracts Service: Columbus, OH, 1907- .

Weekly issues presenting abstracts of the world's literature including all scientific and technological papers containing new information of chemical or chemical engineering interest in journal articles, patents, technical reports, reviews, conference proceedings, symposia, dissertations, and books. Classified by chemical subject arranged in 80 subject sections subdivided by literary forms. Author, patent and keyword subject indexes included. Issues bound semiannually.

Chemical Abstracts: Patent Index; Chemical Abstracts Service: Columbus, OH, 1981- .

Provides access to abstract numbers of patents in an arrangement classified by country and numerically ordered. Includes new abstracts of patented inventions, cross-references to first abstracted document on an invention, and a list of first abstracted of all patent documents relating to it. Semiannual volume cumulates the weekly issue index and is cumulated every five years. Continues Numerical Patent Index, 1935-1980 and Patent Concordance, 1965-1980.

Chemical Abstracts Service Chemical Substance Name Selection Manual; Chemical Abstracts Service: Washington, DC, 1978.

User aid for the Chemical Substance Index providing details of nomenclature use for the 9th and 10th collective indexes.

Chemical Abstracts Service Source Index (CASSI); Chemical Abstracts Service: Columbus, OH, 1907-1984.

A cumulative online and print source including comprehensive bibliographic information and holdings of 398 international libraries for journals, conference proceedings, technical reports, monographic series, and edited monographic collections in chemistry, engineering, biology, and physical sciences which have been abstracted in Chemical Abstracts or Engineering Index or covered by BIOSIS or ISI. Entries arranged alphabetically by abbreviated titles.

Ring Systems Handbook; Chemical Abstracts Service: Columbus, OH, 1984.

A user aid for the Chemical Substance Index of Chemical Abstracts giving a catalog of structural diagrams and associated data for all ring and cage systems appearing in CA since 1907. The two 1984 volumes have five supplements to date and replace the Parent Compound Handbook and a The Ring Index.

Subject Coverage and Arrangement of Abstracts by Sections in Chemical Abstracts; Chemical Abstracts Service: Columbus, OH, 1975.

A manual providing a summary of the guidelines of policies used in classifying abstracts by subject content in CA and a classified inventory to the chemical and chemical engineering literature accessed through CA. Includes for each section a description of subjects covered, related subject access, cross-reference policies, and arrangement of sub-sections.

III. Secondary Literature - Organized
C. Other Abstracting Services

Abstracting and indexing services provide periodical bibliographic guides for current and retrospective use of literature such as journals, patents, theses, conference papers, reviews, and new books. Indexing journals to the primary literature include single journal indexes and indexing journals providing subject access to the contents of many primary sources or a single literature type in closely related fields. Abstracting journals provide the same types of access with the addition of an indicative or informative summary of the contents of the primary literature. Abstracts and indexes arranged by subject may include additional indexes arranged by other access points.

Abstracts and indexes vary in the scope of subjects included, the types of literature covered, the exhaustivity of coverage, and the time delay in publication. With continuing growth in the size and diversity of chemical literature and increasing emphasis on rapid dissemination, the number of abstracting and indexing products is increasing as the number of abstracts which are multidisciplinary or comprehensive in coverage of broad disciplines is declining. Four abstracting services for the international field of chemistry have recently ceased publication or changed to a narrower scope: Chemisches Zentralblatt (1830-1969), British Abstracts (1926-1953), Nippon Kagaku Soran (1927-11974), and Bulletin Signaletique (1940-1983). Referativnyi Zhurnal, Khimiya (1953-) and Chemical Abstracts (1907-) continue to provide comprehensive, international coverage of many types of chemical and related literature. Science Citation Index (1961-) provides access to international, interdisciplinary journal articles by relating source and citing articles, an approach which is amenable to automation. Other interdisciplinary indexes such as Applied Science and Technology Index and General Science Index provide limited coverage of journals only.

An increasing number of abstracts and indexes are aimed at subdisciplines of chemistry, special subjects, or a specific form of literature. Such services may provide greater depth of coverage, more detailed abstracts, specialist's perspective, easier use, and specialized presentations. Examples of subject specialized A & I products include: Index Chemicus (organic compounds and synthesis), Analytical Abstracts (analytical chemistry), Metals Abstracts (chemistry, physics, and technology of metals). A & I products specializing in a type of literature, such as the Derwent Central Patent Index and Index to Scientific Reviews, will be discussed under that section.

Abstracts and Indexes covering peripheral subjects of interest to chemists may also be consulted in comprehensive retrospective searches. Locating appropriate A & I products is facilitated by guides such as A Guide to the World's Abstracting and Indexing Services in Science and Technology or Ulrich's International Periodical Directory.

Collected or cumulated abstracts and indexes are used for retrospective literature searches. Current issues of abstracting and indexing journals may be used for current awareness . In addition, some services publish standard interest profile products and alerting services to minimize the searching efforts of users and diminish the time delay.

Biblioigraphy
Secondary Literature
Other Abstracting and Indexing Services

Applied Science and Technology Index; H. W. Wilson: New York, 1913- .
A general cumulative subject index to over 400 technical periodicals written in English including the leading chemistry and chemical engineering journals and some books and pamphlets. Alphabetically arranged by subject categories.

The Engineering Index; Engineering Information: New York, 1884- .
A compilation of abstracts to over 2,000 international journals, technical reports, monographs, conference proceedings, and directories covering all engineering disciplines. The monthly issues are arranged according to subject headings and sub-headings, liberally cross-referenced, and supplemented with author and subject indexes. Issues are cumulated annually with author and author affiliation indexes, correlation lists for monthly and annual abstract numbers, and a list of publications.

General Science Index; H. W. Wilson: New York, 1978- .
A cross disciplinary cumulative subject index of 120 English language magazines and journals. Alphabetically arranged by subject categories.

Index Chemicus; Institute for Scientific Information: Philadelphia, 1960- .
(Formerly Current Abstracts of Chemistry and Index Chemicus)
A current awareness weekly guide to organic chemical research and technology providing abstracts of articles from over 112 major journals reporting syntheses, isolation, and identification of new compounds. Abstracts include flow diagrams of syntheses as well as narrative and are accessed by seven indexes: molecular formula, author, subject, biological activity, corporate affiliation, alert to labeled compounds, and journals. Annual cumulations of indexes add a Rotoform index of molecular formulas.

Owen, D. B. Abstracts and Indexes in Science and Technology: A Descriptive Guide; Scarecrow Press: Metuchen, NJ, 1985.
Provides practical descriptions of major scientific and technological abstracts and indexes. Arranged by broad subject areas. Includes title index.

Science Citation Index; Institute for Scientific Information: Philadelphia, 1961- .
International index providing access to articles, subject related through their references, and culled from over 3300 journals covering over 100 disciplines. Presented in fours parts: Citation Index, Source Index, Permuterm Subject Index, and Corporate Index. Published bi-monthly and cumulated annually.

Ulrich's International Periodical Directory: R. R. Bowker: New York, 1932- .
A basic periodical directory format guide giving bibliographic, ordering, and indexing information on 75,000 international periodicals listed alphabetically under 385 subject headings with a title index. Substantial subject section on abstracting and indexing periodicals.

III. Secondary Literature - Organized
D. Alerting Services

Collected volumes of abstract and index journals and their cumulated indexes provide access to the literature required for comprehensive, retrospective searches. Current issues of these journals may be used by chemists to keep abreast of the field or specialized subject areas. Some of the more highly computerized abstracts and indexes, such as Index Chemicus and Science Citation Index, are sometimes classified as current awareness products. Disadvantages of this method of current awareness include the long time delay in publication of most abstract journals and the necessity of scanning a large volume of abstracts to find pertinent information.

In response to the increasing need of chemists for rapid access to current information directed at specific interests, the abstracting and indexing services have developed a variety of new products by emphasizing special interests and taking advantage of the computerization of A & I services. Print formats of alerting services include publications covering sections of abstracts, specific current awareness publications, and standard interest profile publications.

The ACS Section Groupings of Chemical Abstracts are complete reproductions of subject related sections which provide abstracts in the areas of biochemistry, organic chemistry, macromolecular chemistry, applied chemistry/chemical engineering, and physical/analytical chemistry. They reduce the size and price of the abstracts needed by individuals. However, they cover the same broad areas found in the full publication and are no more current.

Specific current awareness publications are computer generated for rapid access to information. Title keyword indexes, such as Chemical Titles, present limited subject access to information in selected core journals. Contents publications, such as the Current Contents series provide tables of contents of selected journals for scanning by workers in broad fields. Custom contents may also be provided users specifying limited journals of interest.

Standard interest profile or macroprofile print products, such as CA Selects and ASCATOPICS, provide abstracts from A & I databases focused on specific limited areas of interest. Customized print SDI services are also available.

Bibliography
Secondary Literature
Current Awareness

Chemical Titles: Chemical Abstract Service: Columbus, OH, 1961- .

A semimonthly current awareness tool presenting title keyword and author indexes for selected papers from about 750 core journals in chemistry and chemical engineering. Codens given in the indexes lead to journal tables of contents from which complete citations are obtained. Reprints of articles available from the CAS Library Document Service.

Current Chemical Reactions: Institute for Scientific Information: Philadelphia, 1979- .

A monthly guide to new and newly modified organic reactions and syntheses reported in the 112 organic chemistry journals abstracted in Index Chemicus. Contains bibliographic information, reaction flow diagrams, author abstracts and product yields when available, descriptions of reaction type, notices of explosive reactions, and bibliographic information on review articles. The author, journal, corporate, and permuted subject indexes are cumulated annually.

Current Contents: Physical, Chemical, and Earth Sciences: Institute for Scientific Information: Philadelphia, 1961- .

A current awareness tool providing access to the table of contents of nearly 1000 of the most important research journals in chemistry and related sciences on a weekly basis. Cross referenced to other Current Contents and indexed by title words and authors. Provides document delivery service through The Genuine Article and includes contents of new multi-authored books, publishers address directory, and one article by the publisher.

IV. Secondary Literature - Evaluated
A. Dictionaries and Encyclopedias

Dictionaries are alphabetical word lists providing definitions and information on usage, derivation, and pronunciation. Although general dictionaries include many scientific terms, the breadth of unique scientific and technical vocabulary creates a need for special dictionaries. The scope of these dictionaries varies from broad coverage of the entire field for general readers to coverage of specialized terms of subfields and special topics for sophisticated users. The length of definitions in dictionaries varies from a few words to several paragraphs, the latter format providing a bridge to encyclopedias.

Varying forms of word tools address specific needs of scientists and technologists. Glossaries may be issued as standards in a field to provide limited lists of defined words (Compendium of Chemical Terminology: IUPAC Recommendations). Thesauri are controlled vocabulary lists which present relationships among terms rather than definitions. They may be reference tools for indexing or retrieving technical information or for accessing acceptable synonyms for scientific terms and nomenclature (Thesaurus of Engineering and Scientific Terms, Pharmacological and Chemical Synonyms). Special dictionaries may contain only translations of abbreviations, acronyms, initialisms, contractions, codes, and trademarks (Concise Chemical and Technical Dictionary). Some dictionaries specialize in the etymology of words (The Dictionary of Chemical Names). Works containing eponyms present the scientific and technical terms based on the names of people (A Dictionary of Named Effects and Laws in Chemistry, Physics, and Mathematics). Bilingual and multilingual dictionaries aid in translating foreign literature (Dictionary of Chemistry and Chemical Engineering, Dictionary of Chemistry and Chemical Technology in Six Languages).

The variety and number of scientific and general dictionaries as well as the failure to indicate content in the title, complicate selection of the best reference work. Location of the correct dictionary is aided by guides to the scientific literature or by specialized tools such as A Bibliography of Scientific, Technical, and Specialized Dictionaries.

General encyclopedias present general readers with summaries of alphabetized topics covering all branches of knowledge including science. They contain concise background information with limited specific data and references. Similar encyclopedias exist in the narrower field of science and technology. Encyclopedias for specialists in science and technology present information on a clearly defined discipline, subdiscipline, or topic in a scholarly and technical format with references to primary sources. The depth of coverage increases with decreasing scope of coverage and increasing article length and number of volumes.

Encyclopedias are intended as introductions to a topic. Despite the publication of revised editions and the use of supplementary annuals for multivolume sets, they lack the currency usually required by chemists. The breadth and depth of information required by subject specialists is found in the primary literature or in other, more comprehensive secondary sources such as treatises and reviews.

Bibliography
Secondary Literature - Evaluated
Dictionaries and Encyclopedias

Acronyms, Initialisms, and Abbreviations Dictionary: Towell, J. E.; Sheppard, H. E., Eds.; Gale Research: Detroit, MI, 1988.

The 12th edition of this dictionary provides meanings for three volumes of acronyms, initialisms, and abbreviations used in a broad range of fields in alphabetical order by the acronyms. Sources for the acronyms are listed. Updated by the annual New Acronyms, Intialisms, and Abbreviations. Complemented by Reverse Acronyms, Initialisms, and Abbreviations Dictionary which lists the same information alphabetically by the meanings.

Ballentyne, D. W. G.; Lovett, D. R. A Dictionary of Named Effects and Laws in Chemistry, Physics, and Mathematics: Chapman and Hall: New York, 1980.

A specialized dictionary providing a glossary of eponyms with definitions. Includes cross references and a list of named units with definitions.

A Bibliography of Scientific, Technical, and Specialized Dictionaries: Polyglot, Bilingual, Unilingual: Rechenbach, C. W.; Garnett, E. R., compilers; Catholic University of America Press: Washington, DC, 1964.

A bibliography of dictionaries, language dictionaries, and glossaries for the subdivisions of science and technology and a selection of other specialized fields. Includes sections on abbreviations/acronyms and slang. Indexes by languages, subjects, and compilers.

Compendium of Chemical Terminology: IUPAC Recommendations: Gold, V.; Loening, K. L.; McNaught, A. D.; Sehni, P., Compilers; Blackwell Scientific Publications: Boston, 1987.

A collection of concise, approved definitions from IUPAC, IUPAC-IUB, and PAC sources. This glossary provides cross-references and references to source documents for each definition.

Concise Chemical and Technical Dictionary: Bennett, H., Ed.; Chemical Publishing: New York, 1986.

Dictionary of over 8,000 concise definitions for trademark products, chemicals, drugs, abbreviations/acronyms, and related scientific terms. Appendixes include information on elements, temperature and measurement conversions, symbols, chemical indicators, and organic ring systems.

Condensed Chemical Dictionary: Sax, N. I.; Lewis, R. J., Eds.; Van Nostrand Reinhold: New York, 1987.

A compendium of technical data and descriptive information covering thousands of chemicals, equipment, chemical phenomena, terms, and trademarks.

CRC Handbook of Chemical Synonyms and Trade Names: Gardner, W.; Cooke, E.I.; Cooke, R. W. I., Eds.; CRC Press: Cleveland, OH, 1978.

Dictionary giving definitions of commonly used terms and trade names with codes for manufacturers of proprietary products and cross-references for synonyms.

Dictionary of Chemistry and Chemical Engineering: DeVries, L.; Kolb, H., Eds.; Verlag Chemie: Deerfield Beach, FL, 1979.

A bilingual, two volume dictionary providing translations of German into English and English into German for terms used in pure and applied chemistry, chemical engineering, and allied fields.

Dictionary of Chemistry and Chemical Technology in Six Languages: Sobecka, Z.; Majurek, P.; Choinski, W., Eds.; Pergamon Press: New York, 1966.

A multilingual dictionary providing translations only from English into German, Spanish, French, Polish, and Russian. The 12,000 terms are selected from all branches of theoretical and applied chemistry, chemical engineering, and chemical and related technologies with the addition of other essential scientific terms encountered in the chemical literature.

Encyclopedia of Chemical Technology: Grayson, M.; Eckroth, D., Eds.; John Wiley & Sons: New York, 1978. (Kirk-Othmer)

A comprehensive, multivolume encyclopedia containing substantial articles by field experts. Includes extensive references to both primary and secondary literature for the articles, an index volume, and a 1984 supplement volume.

Flood, W. E. The Dictionary of Chemical Names: Philosophical Library: New York, 1963.

An etymological dictionary exploring the origins of chemical nomenclature for elements, basic compounds, minerals, and other substances of chemical interest. Provides an expository chapter, biographical notes, and some obsolete terms of historical interest.

Glossary of Chemical Terms: Hampel, C. A.; Hawley, G. G., Eds.; Van Nostrand Reinhold: New York, 1982.

A selection of terms used in chemistry with definitions and limits of meaning for each varying from a few sentences to a full column. Includes biographical information on prominent chemists and many cross references.

Grant & Hackh's Chemical Dictionary: Grant, R.; Grant, C., Eds.; McGraw-Hill Book: New York, 1987.

This 5th edition of Hackh's Chemical Dictionary defines words generally used in chemistry and related sciences culled from the scientific literature. Includes figures, tables, and formulas.

McGraw-Hill Dictionary of Chemistry: Parker, S., Ed.; McGraw-Hill Book: New York, 1984.

A dictionary of terms used in theoretical and applied fields of chemistry and atomic and nuclear physics. Synonyms, acronyms, and abbreviations are included in the definitions and are cross-referenced in the alphabetical listing. Includes empirical and line formulas.

McGraw-Hill Dictionary of Scientific and Technical Terms; Parker, S., Ed.; McGraw-Hill Book: New York, 1984.

A general science and technology dictionary relating defined terms to 100 specific fields. Synonyms, acronyms, and abbreviations are included in the definitions and are cross-referenced in the alphabetical listing. Appendix includes extensive information on symbols, constants, abbreviations, taxonomy, and an annotated list of scientists.

McGraw-Hill Encyclopedia of Science and Technology; McGraw-Hill Book: New York, 1987.

A multivolume, general science and technology encyclopedia for students and professionals. Articles written by experts contain general information, details, and references. Features include an index volume, illustrations, tables, graphs, and cross-references.

A New Dictionary of Chemistry; Miall, L. M.; Sharp, D. W. A.; Eds.; John Wiley & Sons: New York, 1968.

A dictionary approaching encyclopedia form which provides explanations of chemical terms with brief accounts of selected important substances, chemical operations, and chemists.

Ocran, E. B. Ocran's Acronyms: A Dictionary of Abbreviations and Acronyms Used in Scientific and Technical Writing; Routledge and Kegan Paul: London, 1978.

Decodes abbreviations and acronyms in broadly defined scientific and technical fields in both an alphabetical list and a list classified by general subject field. Entries selected from recent journal articles.

Patai, S. Glossary of Organic Chemistry: Including Physical Organic Chemistry; John Wiley & Sons: New York, 1962.

Basic explanations of terms and reactions commonly found in organic and physical organic chemical literature. References keyed to list of review publications, textbooks, monographs, synthetic works, analytical works, and chemical literature guides.

IV. Secondary Literature - Evaluated
B. Handbooks, Data Sources, and Methods

Handbooks are ready reference books providing systematic, condensed information commonly required on a topic or field gathered by a team of experts from the primary literature. Most common handbooks are published in one volume and contain extensive compilations of quantitative data in tabular form with detailed tables of contents and comprehensive indexes as access aids for users. Good handbooks are regularly updated to insure currency of information. Most handbooks contain very limited references to sources of the data.

There are several variations from this basic format. Data compilations and mathematical tables are handbooks which specialize in numerical data in tabular or graphic form providing a greater depth and breadth of coverage than in general handbooks and lacking their supplementary supporting information. Methods sources and formularies are guides to techniques in the synthesis of compounds and preparation of mixtures and include related handbook information. Comprehensive handbooks, such as the German handbuchs, cover in multiple volumes a broad scope of data for an entire field of chemistry from its inception to the publication date. They are sometimes considered treatises due to their comprehensive coverage, emphasis on documentation, and critical evaluation of the data included. The term manual is technically a Latin based synonym for handbook but is generally used in the sense of a laboratory manual or teaching tool for scientific experimentation.

Access to data is of vital importance to chemists. Several international and national organizations supply services to promote the availability of critically evaluated physical and chemical data and provide publications containing such data. These include the International Union of Pure and Applied Chemistry (IUPAC), the Committee on Data for Science and Technology (CODATA) under the International Council of Scientific Unions, the Office of Scientific and Technical Information (OSTI) in the United Kingdom, the State Service for Standard and Reference Data (GSSSD) in the USSR, and the National Standard Reference Data System (NSRDS) of the Office of Standard Reference Data (OSRD) in the United States. The latter is part of the National Bureau of Standards (NBS) in the Department of Commerce.

Handbooks and Tables in Science and Technology is one of the few specialized guides to the literature for this format. Bibliographies of handbooks may also be found in general guides to the chemical literature. Antony's Guide to Basic Information Sources in Chemistry provides chapters on both general and specialized compilations of data. Wolman's Chemical Information: A Practical Guide to Utilization includes information on sources for data organized according to data types: melting and boiling points, crystallographic data, spectral data, thermophysical and thermochemical data, kinetic data, and solubility data.

Bibliography
Secondary Literature - Evaluated
Handbooks, Data Sources, and Methods

Beilstein Dictionary: German-English for Users of the Beilstein Handbook of Organic Chemistry; Springer-Verlag: New York, 1979.

A user's tool for Beilstein's Handbuch der Organischen Chemie providing a glossary of German terms used in the handbook with English translations. Translations are also provided for sentences and long phrases frequently repeated in the German work.

Beilstein's Handbuch der Organischen Chemie: Springer: Berlin, 1918- .

A comprehensive, multivolume handbook of carbon compounds presented in a Basic Series and five Supplementary Series which together cover the literature from the beginning of organic chemistry to 1980. The comprehensive coverage of the subject matter, the full documentation of data, and the critical evaluation of material selected leads some authors to classify Beilstein's as a treatise. Entries include nomenclature, empirical formula, constitutional formula, configuration, natural occurrence and isolation from natural products, preparation and purification, structural and energy parameters, physical and chemical properties, characterization and analysis, and salts and addition compounds. Arrangement of compounds is according to a unique system with major division into acyclic, isocyclic, and heterocyclic compounds and subdivision into classes according to functional groups. Cumulative subject and formula indexes cover the Basic Series and Supplementary Series I and II. Various indexing exists for series III, IV, and V including volume indexes. Supplementary Series V is available in English.

Chemical Engineers' Handbook; Perry, R. H., Ed.; McGraw-Hill: New York, 1973.

A one volume general handbook with 25 sections of physical properties slanted toward the industrial chemist and engineer. Minimum narrative explanation and references accompany the tables and graphs.

The Chemical Formulary; Bennett, H., Ed.; Chemical Publishing: New York, 1933- .

Information on the preparation of products from a variety of chemical industries including apparatus, methods, and cost calculations. New formulas in each volume with a repetition of instructional material on techniques and basic examples. Includes information on Federal laws, incompatible chemicals, first aid for chemical injuries, trademark chemicals, and tables of weights and measures.

Compendium of Organic Synthetic Methods; John Wiley & Sons: New York, 1971- .

A comprehensive, systematic listing of methods for syntheses in all branches of organic chemistry based on reactant and product functional groups. Entries provide reference to the primary literature; limited cross-references; per cent yields; and equations giving reactants, reagents, physical requirements, and products. Five volumes to date.

CRC Atlas of Spectral Data and Physical Constants for Organic Compounds; Grasselli, J. G., Ed.; CRC Press: Cleveland, OH, 1973.

A two volume comprehensive compilation of evaluated physical and spectral data for organic compounds. Includes references to Beilstein's Handbook and indexes from a variety of access points.

CRC Handbook of Chemistry and Physics; Weast, R. C.; Astle, M. J., Eds.; CRC Press: Boca Raton, FL, 1913- .

Comprehensive one volume handbook including tabular data on the physical and chemical properties of organic and inorganic compounds, math tables, and conversion tables. Limited references to Beilstein's Handbook. Includes structures, graphs, and a subject index. One of a series of desktop handbooks in scientific fields.

CRC Handbook of Data on Organic Compounds; Weast, R. C.; Astle, M. J., Eds.; CRC Press: Boca Raton, FL, 1985.

Two volume compilation of physical and chemical data on organic compounds with references to Beilstein's Handbook and CAS registry numbers for access to primary literature.

Dictionary of Organic Compounds; Buckingham, J., Ed.; Chapman and Hall: New York, 1982.

A handbook in dictionary form proving comprehensive information on organic compounds including alternate nomenclature, CAS registry number, formulas, toxicity and hazard information, physical data, and bibliographic references. The five main volumes have four indexes: name, molecular formula, heteroatom, and CAS registry number. The annual supplements contain cumulative name and formula indexes covering supplements only.

Handbooks and Tables in Science and Technology; Powell, R. H., Ed.; Oryx Press: Phoenix, AZ, 1983.

An annotated bibliography to over 3,000 handbooks, databooks, manuals, and source books emphasizing data tabulations and compilations in science, technology, and medicine. Indexed by author, subject and publisher.

Handbook of Preparative Inorganic Chemistry; Brauer, G., Ed.; Academic Press: New York, 1963/65.

A two volume guide to methods of inorganic synthesis arranged according to elements. Includes information on preparative methods, and three indexes: subject; formula; and procedures, materials, and devices.

How to Use Beilstein; Springer-Verlag: New York, 1978.
An introductory guide to Beilstein's Handbook with information on the contents and arrangement of the series and explanation of how to find compounds by use of the indexes and Beilstein system. Provides history, references, charts, examples, and flow chart of searching procedure.

Landolt-Bornstein Numerical Data and Functional Relationships in Science and Technology: New Series; Hellwege, K. H.; Madelung, O., Eds.; Springer-Verlag: New York, 1961- .
Comprehensive handbook of physical properties and related data arranged in six multivolume groups: Nuclear and Particle Physics, Atomic and Molecular Physics, Crystal and Solid State Physics, Macroscopic and Technical Properties of Matter, Geophysics and Space Research, and Astronomy, Astrophysics, and Space Research. Some volumes in English, others in German with headings in English. Access aided by detailed table of contents and a separate cumulative index covering the New Series and the 6th edition of the basic series.

Lange's Handbook of Chemistry; Dean, J. A., Ed.; McGraw-Hill: New York, 1985.
A Handbook in one volume covering tabular information on mathematics, conversion factors, atomic and molecular structure, and physical properties. Sections on inorganic, analytical, and organic chemistry; electrochemistry; and spectroscopy. Limited references to Beilstein's Handbook.

The Merck Index: An Encyclopedia of Chemicals and Drugs; Windholz, M., Ed.; Merck: Rahway, NJ, 1976.
Comprehensive, interdisciplinary compendium of chemicals, drugs, and biological substances giving brief descriptions of preparations, general properties, structures, name correlations, trademarks, pharmicological action, toxicity, and bibliographic references. Sections on organic name reactions, miscellaneous tables, and CAS registry numbers. Includes formula index and index of name variations with cross references.

Nemeth, B. A. Chemical Tables; John Wiley & Sons: New York, 1975.
A compilation of tables for students and technicians. Includes extensive coverage of solution densities.

Strauss, H. J. Handbook for Chemical Technicians; McGraw-Hill Book: New York, 1976.
A practical review of basics in chemistry providing brief explanations, formulas, data, and examples of use. Includes some expository material and safety practices.

Weissbach, O. The Beilstein Guide: A Manual for the Use of Beilsteins Handbuch der Organischen Chemie; Springer-Verlag: New York, 1976.
A user's guide and teaching tool for Beilstein's Handbook covering the series up to Supplementary Series IV. Presents information on coverage, organization, finding articles using the indexes and Beilstein system, presentation and organization of articles, and a correlation of German-English-French vocabulary.

IV Secondary Literature - Evaluated
C. Monographs, Multigraphs, and Serials

Scientific and technical books may be separated into four categories which will be discussed in this and the following outline section. Textbooks generally cover a broad subject area and are specifically designed for teaching. Treatises are comprehensive educational and reference tools covering broad subject areas in one or more volumes for subject specialists. Monographs are mini-treatises in single volumes covering relatively current information on single topics or narrow subject areas in detail with full documentation for subject specialists. Their smaller size and scope gives them greater currency than treatises. They are often published as part of series providing a review of progress in a field. The term multigraph is sometimes used to indicate any book in which each chapter or subject section is written by a different subject expert.

Access to scientific books of all types begins with fundamental tools, some of which have already been discussed: card catalogs, union lists, trade bibliographies, general or scientific bibliographies, and general or scientific guides to the literature. Announcements of scientific books to be published are found in Chemical and Engineering News on an irregular basis and in Chemical Abstracts at the end of the appropriate subject section with notation under the subject "Book" in the issue index but not volume indexes.

Reviews of books giving information on their contents with or without critical evaluation may be found in journals such as: Analytical Chemistry, Journal of the American Chemical Society, New Scientist, Science, and Nature. The Journal of Chemical Education provides a monthly section for detailed reviews of books and announcements of new monographs in continuing series. Two monthly issues of the journal give expanded information on books: a guide to books in September and an index to the journal's book reviews in December. Technical Book Review Index provides access to reviews in many publications.

Serials are publications issued in parts over an indefinite period. They include irregular serials such as some review serials and periodicals such as journals or annual reviews of progress. Journals and access to them will be discussed under primary literature.

Bibliography
Secondary Literature - Evaluated
Monographs, Multigraphs, and Serials

Index to All Books on the Physical Sciences: In English, 1967 through January 1974; MARC 2 Research: Rockville, MD, 1974.

A computer produced access tool to over 22,000 English language books on astronomy, chemistry, geology, mathematics, meteorology, and physics. Includes a subject index.

Irregular Serials & Annuals: An International Directory; R. R. Bowker: New York, 1983.

A companion to Ulrich's International Periodicals Directory giving information on 37,000 serials, annuals, continuations, conference proceedings, and other publications issued less than twice a year. Provides basic bibliographic information, ordering information, features, and one or two word annotation.

Pure and Applied Science Books 1876-1982; R. R. Bowker: New York, 1982.

Six volume bibliography of 220,000 entries on 56,000 topics based on LC headings covering all disciplines in science and technology. Includes some titles earlier than the 1876 start date and indexes by author and titles.

The Standard Periodical Directory; Oxbridge Communications: New York, 1983-84.

Provides subject and ordering information on more than 60,000 American and Canadian periodicals in 240 subject categories. Defines a periodical as a publication with issues appearing at least once every two years. Includes a title index and a subject index with see and see also references.

Technical Book Review Index; JAAD Publishing: Pittsburg, PA, 1935- .

A monthly publication providing an index to and extracts from book reviews in 2,500 current scientific, technical, medical, and trade journals. Arranged in five subject sections: pure science, life science, medicine, agriculture, and technology. Indexed by book authors.

IV. Secondary Literature - Evaluated
D. Treatises and Reviews

In response to the increase in scientific and technical knowledge and literature, scientists have gradually narrowed their fields of specialization. This narrowing of competence has led to a growth in collaborative research efforts including interdisciplinary cooperation. These trends have increased the need for the scientist to have access to current, comprehensive, condensed, and critically evaluated information in her own and other subject areas. The treatise and review are forms of secondary literature which fill these needs.

The treatise presents a comprehensive, fully documented, theoretical coverage of the paradigms of a broad field and their empirical foundation with critical discussion written by experts for subject specialists. Published in one or several volumes, it is both an educational and reference tool. A treatise is more comprehensive than an encyclopedia which provides summaries of fundamental concepts in abbreviated form for general readers. A textbook provides a broad overview of the fundamental concepts in related subjects for the education of beginners in the field.

The review also has elements in common with the treatise in its critical review of fully documented information prepared by experts for subject specialists. The review, however, collects a large amount of related, current information in a subject or field. It may be comprehensive or selective, and is generally less fundamental, less organized, and less condensed than a treatise. In addition to educational and reference purposes, it serves a current awareness function. These state of the art reports are most often found in review articles in journals, in review journals, or in monographic series.

Access to review literature may be found in general tertiary works on serials or in specialized indexes to reviews such as Chemical Abstracts Review Index or Index to Scientific Reviews by ISI. Individual review articles may be found in Science Citation Index by an "R" designation and in Chemical Abstracts by the "R" designation in the abstract number in volume and collective indexes or by checking the word "review" in the keyword and subject indexes. Journals which occasionally publish review articles include Chemical and Engineering News, Education in Chemistry, Journal of Chemical Education, and Nature. Journals which contain only review articles include Chemical Reviews, Chemical Society Reviews, Reviews of Pure and Applied Chemistry, and the series of journals whose titles begin CRC Critical Reviews in ...

Treatises may be accessed with the same tools as other books.

Bibliography
Secondary Literature - Evaluated
Treatises and Reviews

Advances in Organometallic Chemistry: Stone, F. G. A; West, R., Eds.; Academic Press: New York, 1964-

A series of multigraphs containing reviews of recent developments on all aspects of organometallic chemistry including synthesis, properties, reactions, application of modern structural techniques, and technological applications. Includes extensive references.

Annual Reports in Organic Synthesis: Academic Press: New York, 1971-

An annual review series presenting condensed reports on current progress in organic synthesis from over 45 primary chemical journals in sections according to reaction type. Entries include synthesis title; citation to the literature; and reaction sequence with essential reagents, conditions, and percent yield. Provides citations for review articles.

The Chemistry of Heterocyclic Compounds: A Series of Monographs: Weissberger, A.; Taylor, E. C., Eds.; John Wiley & Sons: New York, 1951-

A monographic/multigraphic series designed as a literature review for all heterocyclic classes giving theoretical information, syntheses, and physiological and industrial significance. Over 40 volumes published to date, each covering one or two classes of ring structures. Provides extensive references, structures, reaction sequences, and tables.

Comprehensive Inorganic Chemistry: Trotman-Dickenson, A. F., Ed.; Pergamon Press: London, 1963.

A five volume treatise containing comprehensive articles on the elements by subject experts. Volumes cover specific sections of the periodic table.

Comprehensive Organic Chemistry: The Synthesis and Reactions of Organic Compounds: Stoddart, J. F., Ed.; Pergamon Press: New York, 1979.

A treatise providing comprehensive articles on the synthesis and reactions in organic and bio-organic chemistry. The approach is mechanistic; the emphasis 20th century; the arrangement of six volumes by compound type. Includes extensive references and five indexes: author, formula, subject, reagent, and reaction.

A Comprehensive Treatise on Inorganic and Theoretical Chemistry: Mellor, J.W., Ed.; Longmans Green: New York, 1922-1937.

A 16 volume treatise arranged according to the elements giving a complete description of all compounds known in inorganic chemistry from a physical chemical approach. Cumulative subject index in volume XVI.

Fieser, L. F.; Fieser, M. Reagents for Organic Synthesis; John Wiley & Sons: New York, 1967- .

A series of review books containing current information on organic synthetic reagents culled from primary and secondary literature. Entries in the alphabetical list of reagents include name; structural formula; physical data; preferred method of preparation or purification; suppliers; and examples of significant uses with extensive references and flow sheets of molar ratio of reactants, reaction conditions, and yields. Includes an alphabetical list of suppliers and indexes for authors, subjects, apparatus, and reagents by type.

Gmelin's Handbuch der Anorganischen Chemie; Verlag Chemie: Leipzig, 1924- .

A comprehensive, multivolume treatise on inorganic, organometallic, and physical chemistry covering the history, occurrence, properties, scientific methods of preparation, and commercial process of manufacture of all the elements and their compounds. The German text incorporates considerable data and is augmented with tables, charts, and drawings. English translations of divisions and subdivisions have been printed in the margins in volumes published since 1950, and in 1982 complete English versions became available. The eighth edition, begun in 1922, and its supplement volume, begun in 1954, cover the literature from the middle of the 18th century up to 1950 and are updated by the New Supplement Series volumes begun in 1970. Main and supplementary volumes are shelved together according to an alphabetical arrangement of the elements with compounds classified under the latest possible entry. Subject indexing is available for some sections. A twelve volume General Formula Index covers all compound through 1975 in an alphanumeric arrangement.

Index of Reviews in Organic Chemistry; Lewis, D. A., Ed.; The Chemical Society: London, 1968- .

An irregular series of publications, supplements, and cumulations presenting an index to English language review articles on organic chemistry. Arranged by broad subject with subdivisions for articles on individual compounds or classes, name reactions, and specific chemical processes or phenomena.

Index to Scientific Reviews; Institute for Scientific Information: Philadelphia, 1974- .

A semiannual providing bibliographic control of all scientific review and review type articles in over 3,000 journals and monographic literature published in 100 subject disciplines in science, medicine, and technology. Includes four indexes: source, corporate, permuterm, and research front specialty.

International Review of Science; Butterworth: Boston, 1973- .

The initial series consists of five multivolume sets of authoritative, critical reviews covering the disciplines of physical chemistry, inorganic chemistry, organic chemistry, biochemistry, and physiology. Each volume is a multigraph of articles on a theme within the discipline. Includes extensive references, graphs, mathematical expressions, and reaction sequences. Some series have been updated.

Kharasch, N.; Wolf, W.; Harrison, E. C. P.; Index to Reviews, Symposia Volumes, and Monographs in Organic Chemistry; Pergamon Press: New York, 1962.

A multi-form index for organic chemistry providing basic bibliographic information for English, French, and German documents. The initial volume covers the period 1940-1960 and is updated by annual supplements. Includes author and subject indexes and publisher addresses.

Organic Reactions; John Wiley & Sons: New York, 1942- .

An annual literature review giving comprehensive coverage of the more important organic synthetic reactions from a preparative viewpoint. The critical discussions by experts give attention to limitations, interfering influences, effects of structure, and selection of experimental techniques. Includes extensive tables and references and cumulated author and subject indexes in select volumes.

Organic Syntheses: An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals; John Wiley & Sons: New York, 1921- .

Experimental procedures presented by workers in the field for compounds of wide interest or illustrating important new developments in methodology. Each reaction is verified before publication. Entries include reaction sequence, names of experimenters and checkers, procedural details, and references to CA with registration number. The annual publication is published in ten year cumulations through volume 50, 1970. Every fifth volume contains cumulated author and subject indexes.

Physical Chemistry: An Advanced Treatise; Academic Press: New York, 1971-1975.

Each of the sixteen volumes in this comprehensive treatise contains several articles written by experts around a central theme. Provides elementary theory and fact in concise form for advanced students and investigators.

Rodd's Chemistry of Carbon Compounds; Coffey, S., Ed.; Elsevier Publishing: New York, 1964-1987.

A comprehensive multivolume treatise on organic chemistry. Information organized by compound type: aliphatic, alicyclic, aromatic, heterocyclic and miscellaneous. General subject index in final volume.

Structure and Bonding; Springer-Verlag: New York, 1966- .

Multigraphic series giving authoritative reviews from inorganic chemistry, chemical physics, and biochemistry centering on chemical bonding of a metal and a small number of associated atoms. Includes extensive references, figures, and tables.

Survey of Progress in Chemistry; Scott, A. F., Ed.; Academic Press: New York, 1963- .

A review series covering selected topics summarizing significant changes in the broad field of chemistry for college professors. Multigraphs contain extensive references.

Technique of Organic Chemistry: Weissberger, A., Ed.: John Wiley & Sons: New York, 1945-1969.

A comprehensive presentation of specific tools and techniques used in the organic laboratory for the synthesis, isolation, and purification of compounds and physical methods for determination of properties. Articles by experts give theoretical background, description of techniques, criticism, and references.

Topics in Current Chemistry: Springer-Verlag: New York, 19 - .

A series of monographs and multigraphs each presenting several critical reviews of the present position and future trends in modern chemical research in an area of interest. Includes extensive references, graphs, tables, structures, and reaction sequences.

Treatise on Analytical Chemistry: John Wiley & Sons: New York, 1959-1977, 1st ed., 1978- ,2nd ed.

A multivolume treatise aiming to stimulate research in pure and applied analytical chemistry by presenting a concise, critical, comprehensive, and systematic treatment of all aspects of classical and modern analytical chemistry. Organized in three major parts covering theory and practice, analytical chemistry of the elements, and analytical chemistry in industry. The first editions continues in use during publication of the second edition.

V. Primary Literature
A. Journals

In 1665, the first scientific journal was published as a replacement for the use of personal correspondence to disseminate information and permanently record the advances in science. Journals continue to hold a pre-eminent position as the primary official, public, and verified record of science; the means of disseminating information; and a social institution conferring prestige on authors and editors.

The importance and popularity of journal literature may be seen in the proliferation of the form. From 1750 to 1900 the number of scientific journals increased from 10 to about 10,000, a growth rate of a factor of ten every fifty years. Despite current concerns over an information explosion, the actual rate of growth has declined and recent increases in the literature have reached a steady state. Estimates of current publications in science and technology vary from 25,000 to 50,000 with continued increases stemming from increases in the number of scientists, in research and development, and in specialization; emphasis on publication as a measure of status; and developments in printing technology.

Some of the current problems with journals stem from their proliferation. Articles on a subject may be scattered in many sources, a phenomenon which promotes cross-fertilization of ideas but presents problems of current awareness. The large number of articles presented for publication cause delays in publication if editing quality is maintained and proper refereeing used to maintain high standards of quality and reliability of information. Most journals present a broader scope of information than is needed by today's specialists including not only a broad range of subjects for articles and abstracts but other literature forms such as announcements, bibliographies, book reviews, buyers guides, correspondence, editorials, news items, and personalia. Finally, the cost of many journals has risen beyond the means of individual chemists.

Current trends in journal publication address problems of cost, availability, currency, and specialization. Computer aided production, microform publications, and electronic journals aim at containing costs and decreasing the time between writing and publication. The synopsis journal, in which a shortened version of a journal is published, and the similar auxiliary publication, in which the main text is printed with auxiliary material available on microform, are being tested as means of containing cost and addressing specific user needs. Letters journals containing short, unverified articles decrease delays in publication time. Advance announcements of contents aid scientists in finding pertinent articles with a minimum of effort, time, and cost.

Access to the articles in journals has already been discussed in the sections on abstracting and indexing services, literature guides, subject bibliographies, and reviews. Access to the periodicals themselves is attained through union lists and periodical directories, some of which were discussed under serials.

List of Journals Reviewed

Accounts of Chemical Research

Analytical Biochemistry

Analytical Chemistry

Angewandt Chemie (English translation)

Applied Spectroscopy

Applied Spectroscopy Reviews

Australian Journal of Chemistry

Biochemical Journal

Biochemistry

Bioinorganic Chemistry

Bioorganic Chemistry

Biophysical Chemistry

Canadian Journal of Chemistry

Chemical and Engineering News

Chemical Communications

Chemical Highlights

Chemical Physics

Chemical Reviews

Chemical Society Reviews

Chemistry

Chemistry Letters

CRC Critical Reviews in Biochemistry

Inorganic Chemistry

International Journal of Chemical Kinetics

Journal of Biochemistry

Journal of Biological Chemistry

Journal of Chemical Education

Journal of Chemical Information and Computer Science

Journal of Chemical Physics

Journal of Inorganic Chemistry

Journal of Macromolecular Science-A Chemistry

Journal of Organic Chemistry

Journal of Organometallic Chemistry

Journal of Physical Chemistry

Journal of Polymer Science: Polymer Chemistry Edition

Journal of Solid State Chemistry

Journal of Structural Chemistry

Journal of Synthetic Methods

Journal of the American Chemical Society

Journal of the Chemical Society

Microchemical Journal

Quarterly Reviews

Review of Inorganic Chemistry

Science

Tetrahedron

Tetrahedron Letters

Bibliography
Primary Literature
Journals

Coden for Periodical Titles: American Society for Testing and Materials: Philadelphia, 1966.

An aid to storage and retrieval of information in journals by providing cross access to titles and coden codes, the unique alphanumeric codes for periodical titles in machine-readable and print files. Includes list of deleted coden and non-periodical list for irregular serials coden.

New Serial Titles, 1950-1970: R. R. Bowker: New York, 1973.

Bibliographic and holdings information on 220,000 titles of magazines and journals held in 800 U. S. and Canadian libraries. Continues the Union List of Serials and is updated by a monthly publication with quarterly, annunal and five year cumulations. Includes a list of cessations.

Periodicals on Chemistry: Held by the Science Reference Library: deHamel, C. L., Ed.; Science Reference Library: London, 1982.

A comprehensive alphabetical list of periodicals on chemistry and chemical engineering held by the Science Reference Library of the British Library.

Ulrich's International Periodical Directory: R. R. Bowker: New York, 1932- .

A bibliography of 75,000 current, international periodicals giving ordering information, abstracting and indexing services, and features. Arranged in 385 broad subject with subcategories. Includes a title index. Updated by Ulrich's Quarterly.

Union List of Serials in Libraries of the United States and Canada: Titus, E. B., Ed.; H. W. Wilson: New York, 1965.

A retrospective source of more than 150,000 international magazines and journals held in 956 libraries in the U.S. and Canada. Arranged alphabetically by title.

V. Primary Literature
B. Patents

A patent is a legal document in which an inventor discloses the technical details of her invention in return for the right to exclude others from practicing the invention in that country for a restricted time. The invention must be a new and useful process, machine, manufactured product, or chemical composition or substance, or a new and useful improvement of any of these. For full protection, an inventor must obtain a corresponding patent in every developed country. The inventor is known as the patentee; the person or firm to which the inventor assigns her patent is called the assignee. Patents are distinct from trademarks, a registered name or symbol for a unique product, and from copyrights, a protection from copying an author's written form of expression but not subject content.

Patents are a valuable source of chemical information as nearly all new technology is patented. Of these patents, it is estimated that only 5-20% are published to a significant extent in journals and about 75% partially published, making patents and journals complementary information sources.

Copies of patent documents may be obtained from the Patent and Trademark Office (PTO) in the United States or its counterparts in foreign countries. In addition to selling copies, the PTO allows patrons to use a file of foreign patents received arranged by country and two files of all domestic patents assigned since 1836 arranged by number and by the Patent Classification System. Patrons may also find patents in the patent depository libraries throughout the country. Names and locations are provided in the Index of Patents and in Chemical Abstracts Service Source Index (CASSI).

Bibliographic control of patents is provided by governments and commercial enterprises. The patent office in each country publishes some form of guide to patents granted. The Official Gazette, published weekly in the U. S. since 1872, contains claims for about 1500 patents granted each week arranged according to the 350 classes and 100,000 subclasses of the PTO classification system, indexed by inventor and subject, and accessed with the help of the Manual of Classification.

Chemical Abstracts provides exhaustive coverage for patents of chemical and chemical engineering interest from 20 countries and selective coverage for patents from 11 countries. Each weekly issue contains a numerical patent index with concordance information for equivalent patents. The Patent Index is available in semi-annual and five year cumulations. Derwent Patent Information Services publishes several national and international abstracts and indexes for patents. The Chemical Patents Index provides abstracting and retrieval service for chemical and chemically related patents worldwide. The World Patents Index, a compilation of four weekly gazettes indexing general, mechanical, electrical, and chemical patents specifications from important countries, acts as an advance announcement of patents. The World Patent Abstracts publishes abstracts for patents in separate weekly issues for twelve countries. Finally, some journals announce new patents which fall within their scope of interest.

V. Primary Literature
C. Dissertations

A dissertation is a formal presentation of the results of research by a PhD candidate conducted on an aspect of a subject not previously treated. Candidates for master's degrees are sometimes required to do similar, though smaller, research projects and present the results in theses. These two literature forms provide original information on research and comprehensive state-of-the-art reviews of the literature with extensive bibliographies resulting from the exhaustive literature search conducted by the authors to ensure originality of the research.

Dissertations and theses are not systematically acquired by libraries with the exception of academic libraries holding dissertations and theses produced by their students. Bibliographic control of theses is provided by Master's Theses in the Pure and Applied Sciences Accepted by Colleges and Universities of the United States and Canada, and by Master's Abstracts: A Catalog of Selected Masters Theses on Microfilm. Secondary sources for dissertations include: American Doctoral Dissertations, Comprehensive Dissertation Index, and Dissertation Abstracts International: Part B The Sciences and Engineering. American and Canadian dissertations are indexed in Chemical Abstracts with references to Dissertations Abstracts International for the abstracts. The full text of many dissertations are available for a fee from University Microfilms International (UMI).

Bibliography
Primary Literature
Dissertations

Dissertation Abstracts International: B The Sciences and Engineering: University Microfilms: Ann Arbor, MI, 1938- .

An abstracting service for doctoral dissertations submitted to UMI by nearly 500 participating institutions in North America. The author written abstracts are arranged in 200 subcategories of five major categories: biological science, earth science, physical science, health and environment, and psychology. Dissertations from European institutions published in Part C. Dissertations available from UMI.

Masters Theses in the Pure and Applied Sciences: Accepted by Colleges and Universities of the United States and Canada: Shafer, W. H., Ed.; Plenum Press: New York, 1957- .

An index to almost 300,000 theses titles from 23 Canadian and 202 U.S. Universities in all disciplines. Arranged alphabetically by title under the granting university within 44 subject disciplines of which #7 is chemical engineering and #8 is chemistry/biochemistry.

V. Primary Literature
D. Conferences

Conferences provide opportunities to meet and informally communicate with colleagues and to hear and discuss current research in chemistry. Information on forthcoming conferences may be obtained from chemical news magazines or professional society publications. A broader scope of information on future meetings of technical and scientific interest may be obtained from publications such as Scientific Meetings, World Meetings: United States and Canada, or World Meetings: Outside United States and Canada.

Papers presented at conferences may be published and made available to the public in their original or revised form, sometimes including the discussion which occurred at the meeting. They do not receive the refereeing process used prior to publication of journal articles and may be more speculative in form and presented without documentation. Access to them is complicated by the large number of meetings, variety of languages and publication formats, time delay before publication, and variation in names used for conferences such as seminar, symposium, colloquium, convention, or workshop.

Preprints or reprints of papers may be obtained from authors. Some ACS divisions publish preprints shortly before or after meetings. Collections of abstracts of meeting papers may be published such as the ACS Abstracts of Meeting Papers. Papers and proceedings may be located through special indexes including Conference Papers Index, Index to Scientific and Technical Proceedings, and Index of Conference Proceedings Received by the BLLD. Chemical Abstracts also indexes meeting papers and CASSI may be used to identify published conference proceedings. Proceedings may also be published in continuing monographs such as Advances in Chemistry and accessed with tools used for other serials.

Bibliography
Primary Literature
Proceedings

American Chemical Society Abstracts of Papers; American Chemical Society: Washington, DC, 1937- .

Contains abstracts of papers to be presented at future ACS National Meetings arranged by ACS Division, section, and order of presentation. Provides an author index and a KWIK title index. Full papers available by consulting Chemical Abstracts Author Index.

Directory of Published Proceedings; InterDok: Harrison, NY, 1964- .

Bibliographic directory citing preprints and published proceedings of international congresses, conferences, summer schools, meetings, seminars, and symposia. Aids include reciprocal countries and codes lists; publishers addresses; and indexes for editors, locations, and sponsor/title keywords.

Ei Engineering Conference Index; Engineering Information: New York, 1985- .

A comprehensive index to conferences and papers divided into seven volumes according to engineering area. The eighth volume provides indexes by author, author affiliation, sponsor, conference title, and subject. Entries cover both conferences and individual papers with lists of descriptors provided in lieu of abstracts.

Index to Scientific and Technical Proceedings; Institute for Scientific Information: Philadelphia, 1978- .

Annual index to the published proceedings of over 7,500 conferences, seminars, symposia, colloquia, conventions, and workshops in a broad range of scientific disciplines. Provides contents of proceedings arranged by subject categories and six indexes: category, permuterm subject, sponsor, author/editor, meeting location, and corporate.

XXIVth International Congress of Pure and Applied Chemistry; Butterworths: London, 1974.

A seven volume series presenting the main sections and discussion lectures given at the Hamburg Congress, September 2-8, 1973.

World Meetings-Outside United States and Canada; Macmillan: New York, 1967- .

World Meetings-United States and Canada; Macmillan: New York, 1960- .

Complementary indexes of meetings planned for the specified locations providing dates, location, sponsor, contact person, brief indication of content, number of papers, estimated attendance, attendance restrictions, deadlines, publication information, and the number and kind of exhibitors. Include sponsor indexes with directories, and indexes for title keyword, date, deadline, and location.

V. Primary Literature
E. Reports

Scientific and technical reports are accounts of work accomplished to date on a particular project prepared by the research workers and identified by a coded number. They are generally required at regular intervals by the employer or sponsoring agency to convey information on progress and justify continuance of expenditures of time and money in the research. The report literature is heterogeneous in nature covering a wide range of subjects in science, engineering, technology, or social and behavioral science in diverse forms from brief status reports, to compilations of data and statistics, to detailed accounts or final results of research, to literature reviews and bibliographies. Quality is uneven due to their origin as working documents written by engineers and technologists under strict time limitations and without the formal editing and refereeing given journal articles.

Reports may be used by others to avoid duplication of research, locate sources of support for research, follow work in progress, identify technological trends, or gather current information. They are a source not only of work in progress but of work that was not successful. Successful work originally presented in technical reports may be published later in journals.

There are three categories of work published in reports. Industrial sponsored research is most often commercially classified and available only in house until published in a patent application. Government sponsored research, unless covered by a security classification, is the most easily accessible due to the public commitment of the sponsoring agencies. Academic research not falling under government sponsorship tends to remain inaccessible until published as completed work in journals.

General bibliographic control of government sponsored research reports is provided by Government Reports Announcements & Index of the National Technical Information Service (NTIS), a depository of technical reports in the Department of Commerce, and by the Monthly Catalog of United States Government Publications of the Government Printing Office under the Legislative Branch. The Department of Defense, the National Aeronautics and Space Administration, and The Department of Energy also have technical information units which maintain bibliographic control over their own report literature. Conventional abstracting and indexing services provide some coverage of technical reports which is limited by their commitment to journal literature, the difficulty in obtaining copies of technical reports, and the uncertain status of reports. Limited coverage of reports may also be found in general or specific subject bibliographies.

VI. Special Topics
A. Nomenclature

Considering its origins over time in many locations, by various chemists, and in diverse languages, chemical nomenclature has always shown a substantial uniformity. Despite some regional variations in the names of the elements, the dependence of chemistry on the communication among practitioners in person and in print promoted the use of common forms of nomenclature and the establishment of naming customs before formal rules were formulated.

In the second half of the 19th century the science of chemistry began to grow along with the number of known chemicals and the use of printed publications for communication of research and development. The need for uniformity in chemical names became increasingly apparent. The systems of individual chemists were studied and revised by national groups such as the American Chemical Society Committee on Nomenclature.

After several efforts at international cooperation, the International Union of Pure and Applied Chemistry in 1921 appointed commissions on the nomenclature of inorganic, organic, and biological chemistry. These commissions continue today working in cooperation with national committees for international agreement on nomenclature practices as well as the development of the supplementary systems of structural formulas and notation.

Chemical nomenclature continues to change as improvements are adopted, new areas of the science explored, and new substances synthesized. The current IUPAC standard for inorganic chemicals is the 1971 publication, Nomenclature of Inorganic Chemistry. The basics of modern organic nomenclature are found in the IUPAC's Definitive Report of the Commission on the Reform of the Nomenclature of Organic Chemistry adopted in 1930 and under continuing revision, expansion, and improvement.

Important contributions to organic nomenclature may be found in publications such as the ACS monograph Nomenclature of Organic Compounds, the Ring Systems Handbook from CAS, the IUPAC's Glossary of Terms used in Physical Organic Chemistry, and the work of the combined IUPAC and International Union of Biochemistry (IUB) on the naming of biochemicals. Contributions to chemical nomenclature for all classes of compounds include the Introduction to Chemical Nomenclature by Cahn and Dermer and the "Selection of Index Names for Chemical Substances" in the Chemical Abstracts Index Guide.

Bibliography
Special Topics
Nomenclature

Cahn, R. S.; Derner, O. C.; Introduction to Chemical Nomenclature; Butterworths: Boston, 1979.

Provides basic information on International Union of Pure and Applied Chemistry (IUPAC) nomenclature for both organic and inorganic chemicals, including the development of chemical nomenclature, details of current systems for inorganic and organic chemicals, and special treatment of stereoisomers. Attention given to variation in theoretical rules and common usage.

Chemical Abstracts Service Chemical Substance Name Selection Manual; Chemical Abstracts Service: Washington, DC, 1978.

Two volumes providing details of systematic nomenclature used for the 9th and 10th collective indexes of Chemical Abstracts including principles, molecular skeletons, compound classes, information on stereoparents, and substituent prefixes. Extensive table of contents and subject index which includes discontinued nomenclature.

Chemical Nomenclature Usage; Lees, R.; Smith, A. F., Eds; Ellis Harwood Limited: Chichester, England, 1983.

A symposium attempting to bridge the gap between theoretical use of nomenclature experts and daily usage by chemists.

Davis, C. H.; Rush, J. E. Information Retrieval and Documentation in Chemistry; Greenwood Press: Westport, CN, 1974.

A literature guide and textbook applying principles of indexing abstracting, and retrieval to chemical literature. Presents an introduction to chemical nomenclature.

VI. Special Topics
B. Biographies and Directories

Biographies and biographical directories vary in coverage from brief personal data on scientists to broader information on their lives, views, and accomplishments. They may be used to establish personal communication with scientists for exchange of information or requests of assistance, to identify experts for professional activities, or to learn about the scientists responsible for advances in science. Directories include only living scientists. Biographies may cover living or deceased members of the field or both.

Biographical information may be accessed through many general biographical sources such as the Dictionary of American Biography and its British counterpart the Dictionary of National Biography. The McGraw Hill Encyclopedia of World Biography provides a subject approach to biographical information by providing access to names of men and women important in a specific subject area.

Biographical sources specializing in science include: the Dictionary of Scientific Biography covering deceased scientists, American Men and Women of Science covering living American scientists, the World Who's Who in Science: A Biographical Dictionary of Notable Scientists from Antiquity to Present including living and deceased scientists throughout the world, and Current Bibliographic Directory of the Arts and Sciences covering authors of documents indexed by ISI publications.

Detailed information may be obtained from monographs, anthologies, and autobiographies. Serial publications include Current Biography, a general bibliographic source, and Biographical Memoirs, a publication of the National Academy of Sciences. Biographical information is also available in encyclopedias, some dictionaries, and primary journals.

Bibliographic control of biographical sources is offered by guides to references sources such as Walford's and Sheehy's and by specialized works such as the Biographical Dictionary and Related Works. Indexes to biographical works include Biography Index and Index to Scientists of the World from Ancient to Modern Times: Biographies and Portraits. Chemical Abstracts indexes biographies under the name of the biographee and in the General Subject Index under the term "biography".

Directories are used as reference sources for companies, academic or other institutions, associations, and products or services as well as for individuals. Data for these works are generally obtained by questionaires or from catalogs. Directories become out-of-date rapidly and must be updated frequently.

Bibliography
Special Topics
Biographies and Directories

American Men and Women of Science: R. R. Bowker: New York, 1982.

A who's who of 130,00 living Americans and Canadians in 65 disciplines such as physical and biological science, teaching, public health, engineering, mathematics, statistics, and computer science. Entries include personal statistics, field, education information, professional experience, honors and awards, memberships, research area, and mailing address.

The Biographical Dictionary of Scientists: Chemists: Abbott, D., Ed.: Peter Bedrick Books: New York, 1983.

A selection of the most prominent chemists throughout history with biographies of one paragraph to one page including life information and professional accomplishments. Historical introduction, glossary of chemical terms, and subject index included.

Biography and Genealogy Master Index: Gale Research: Detroit, 1980-1981.

An eight volume index to over three million biographical sketches in 350 current and retrospective biographical dictionaries and directories. Annual supplements are cumulated. Emphasis on living biographees.

Biography Index: A Cumulative Index to Biographical Material in Books and Magazines: H. W. Wilson: New York, 1947- .

A comprehensive quarterly index to international biographies ranging from one paragraph to hundreds of pages located in 2,400 periodicals and 1,000 books. Covers living and deceased subjects and includes obituaries, collections of letters, diaries, memoirs, and bibliographies.

Current Biography: H. W. Wilson: New York, 1940- .

An annually cumulated monthly publication of biographies of international personalities with emphasis on those influencing the American scene. Includes popular style essays on living subjects, obituaries for deceased subjects, and indexes by name and profession.

Dictionary of American Biography: Charles Scribner's Sons: New York, 1974.

A collection of over 17,000 essay biographies by scholarly contributers of deceased Americans or selected foreigners who contributed significantly to American life. The eleven volumes and seven supplements are retrospective to the 17th century.

Dictionary of National Biography: Oxford University Press: London, 1885-1901, 1912-1971.

Scholarly essay biographies of over 32,000 deceased men and women of British or Irish nationality, foreigners who gained eminence in Great Britain, and early American settlers. The original 66 volume set has seven supplements.

Directory of Scientific Directories: Burkett, J., Ed.; Longman Group Limited: Essex, UK, 1979.

An access tool for international directories in science and technology including directories, guides, registers, yearbooks, and address books available in research areas. Arranged by continent, country, and subject and indexed by title and author/editor. Emphasis on industry.

Encyclopedia of Associations: Gruber, K., Ed.; Gale Research: Detroit, MI, 1985.

A comprehensive directory providing detailed information on over 19,000 non-profit American membership organizations of national scope arranged in 17 subject sections with an alphabetical name and keyword index. The second volume contains geographical and executive indexes; the third lists new associations and projects; the fourth is a directory of international organizations.

VI. Special Topics
C. Safety and Environment

Laboratory safety, chemical toxicity, and environmental impact and protection are issues of particular importance to chemists and all who come in contact with chemical products or by-products. The literature in the field is increasing and includes information on safe laboratory practices; chemical effects on humans, animals, and plants; hazardous reactions; flammability or explosive characteristics; methods of pollution prevention or control; biodegradability of substances; and governmental laws and regulations.

Safety and environmental information may be located by contacting company safety departments, governmental officials, environmental groups, or trade associations. Since 1985, Federal regulations mandate the publication, updating, and distribution of Material Safety Data Sheets (MSDS) with all commercial chemicals. Collections of data sheet sets include Compendium of Safety Data Sheets for Research and Industrial Chemicals from VCH Publishers covering 867 chemicals, a General Electric collection from Genium Publishing with over 800 chemicals, and a microform set of nearly 30,000 sheets from Information Handling Services. Basic reference books in the field of chemistry may include references to extensive sources in this field. The Journal of Chemical Education features a regular column on safety and letters to the editor in journals such as Journal of Chemical Education, Chemical and Engineering News, or Chemistry in Britain often contain safety information from workers in the field.

Handbooks specializing in the area of safety include: Sax's Dangerous Properties of Industrial Materials, Clinical Toxicology of Commercial Products, and Handbook of Reactive Chemical Hazards. Other comprehensive reference works on toxicology include the Registry of Toxic Effects of Chemical Substances, the Encyclopedia of Occupational Health and Safety, Patty's Industrial Hygiene and Toxicology, and Hazardous and Toxic Materials. Basic reference books on environmental information include Standard Methods for the Examination of Water and Wastewater and Methods of Air Sampling and Analysis.

Information on governmental laws, regulations, and standards may be found in the daily Federal Register from the Government Printing Office or the Environment Regulation Handbook from EIC/Intelligence. The Bureau of National Affairs publishes two weeklies with information on regulations: Environment Reporter and Chemical Regulation Reporter.

Professional societies and trade associations are sources of information on safety and environmental issues. Specific publications include Safety in Academic Chemistry Laboratories (American Chemical Society, ACS), Health and Safety Guidelines for Chemistry Teachers (ACS), Manual of Hazardous Chemical Reactions (National Fire Protection Association, NFPA), Fire Protection Guide on Hazardous Materials (NFPA), and Hazards in the Chemical Laboratory (Royal Society of Chemistry). Other groups providing printed or other information are The American Institute of Chemical Engineers, The Chemical Manufacturers Association, The National Safety Council, the American Conference of Government Industrial Hygeniats, and the American Society for Testing and Materials.

Safety, toxicity, and environmental information may be located through abstracting and indexing services. Chemical Abstracts includes six sections specifically in this area: Pharmacodynamics (1), Toxicology (4), Propellants and Explosives (50), Air pollution and Industrial Hygiene (59), Waste Treatment and Disposal (60), and Nuclear Technology (71). In addition, the other sections of the General Subject Index include many safety related headings. Chemical Hazards, Health & Safety is a subset grouping of CA produced by computer search of the full database as part of the CA SELECTS series. Chemical Industry Notes is a CAS publication with extracts of reports of specific safety and environmental incidents.

Index Chemicus from ISI routinely indicates biological hazards for the chemicals it indexes. Abstracts on Health Effects of Environmental Pollutants (HEEP) from BioSciences Information Service (BIOSIS) emphasizes toxicity of environmental chemicals and substances for humans and animals. Biological Abstracts from BIOSIS contains abstracts on biological activity. CIS Abstracts from the International Occupational Safety and Health Information Center provides international coverage of safety and disease prevention. A & I services providing information on the environment are Environmental Health and Pollution Control from Excerpta Medica, Environment Abstracts from EIC/Intelligence, and Pollution Abstracts from Cambridge Scientific Abstracts.

Bibliography
Special Topics
Safety and Environment

Chemical Technology Handbook: Guide for Industrial Chemical Technologists and Technicians: Pecsok, R. L.; Chapman, K.; Ponder, W. H., Eds.; American Chemical Society: Washington, DC, 1975.

A collection of information for laboratory workers providing guidance on issues of health and safety and instruction on recording information, using equipment,and interpreting data. Includes information on chemical literature, literature sources, and library use.

CRC Handbook of Laboratory Safety: Steere, N. V., Ed.; Chemical Rubber Company: Cleveland, OH, 1971.

Comprehensive descriptive information for hazard recognition, prevention, and control covering fires, explosions, and exposures to chemicals and biological agents. Includes a long chapter of chemical hazard tables and a subject index.

Environment Abstracts: EIC/Intelligence: New York, 1971- .

Interdisciplinary scientific, technical, and socio-economic coverage of the major English language and selected non-English language environmental and resource literature. Abstracts published ten times a year are arranged by 21 subject sections with supplementary information on conferences and new books. Indexes for subjects, industries, sources, and authors are cumulated annually with an alphabetical list of periodicals, report of the year's issues on the international and national fronts, and directory of governmental contacts.

Environmental Periodicals Bibliography: Environmental Studies Institute: Santa Barbara, CA, 1972- .

Bimonthly index to articles in environmental journals presented in the format of a current contents list with journals arranged alphabetically by title in six subject sections followed by information on their articles. Subject and author indexes cumulated annually.

Hazards in the Chemical Laboratory: Bretherick, L., Ed.; Royal Society of Chemistry: London, 1981.

A multigraph presenting information on fire, chemical, explosion, toxicity, and radiation safety with supplementary information on first aid and legislation. The major section presents an alphabetical list of over 480 flammable, explosive, corrosive, and/or toxic substances commonly used in the chemical laboratory with descriptions of hazards, effects on the body, and first aid. Indexed by subject.

Pollution Abstracts; Cambridge Scientific Abstracts: Bethesda, MD, 1970-

A bimonthly publication organizing international technical literature on environmental pollution. Abstracts arranged in ten subject sections including various forms of pollution and positive forms of action. Subject and author indexes are cumulated annually.

Safe Storage of Laboratory Chemicals; Pipitone, D. A., Ed.; John Wiley & Sons: New York, 1984.

A multigraph consisting of papers from a 1982 ACS symposium covering chemical storage requirements, incompatible chemicals, labeling, spills, computer aids, and several case histories. Includes subject index, glossary of word processing and microcomputer terms, and supplementary information on purchasing, safety equipment, Saf-T-Data labeling, chemical storage checklist, and flash point data.

VI. Special Topics
D. Marketing and Business

Industrial research and development chemists require chemical marketing and business information in order to make informed decisions on areas of research and development to pursue and to justify those decisions to management. Basic reference books in the field are Giragosian's Chemical Marketing Research and Industrial Marketing Research by Donald Lee. The multivolume Chemical Economics Handbook from SRI International and its bimonthly update, Manual of Economic Indicators, provide business, marketing, and technical information on most commercial chemical products and product groups. A variety of reports are published by Chemical Data Services providing chemical marketing and business information including Chemical Plant and Product Data, Chemfacts-Country Series, and Chemfacts-Product Series.

Two useful buyer's guides/directories are Chem Sources-U.S.A. and its companion Chem Sources-Europe which provide information on manufacturers of chemicals. More extensive information on chemical companies is found in the Directory of Chemical Producers-USA. The Thomas Register provides details on products and services and their sources. The Encyclopedia of Associations and other corporate directories may be used to access companies and their officials.

Bibliography
Special Topics
Marketing and Business

Chem Sources - U.S.A.: Directories Publishing Company: Clemson, SC, 1958- .
An annual finding tool for over 100,000 chemicals produced or distributed by 855 U.S. firms. Entries include the trade name of the chemical in alphabetical order with codes for the manufacturer, bulk production, and purity ranking. A company directory provides the contact information for the manufacturers. Secondary access via an alphabetical trade name index, classified trade name index, or company index.

Thomas Register of American Manufacturers and Thomas Register Catalog File: Thomas Publishing: New York, 1905- .
An annual directory of products and services including in 1986: a 12 volume alphabetical list of products and services subdivided by state and city giving company names, addresses, and phone numbers; a two volume list of company profiles; and a seven volume catalog file showing specifications drawings, photographs, and performance data for the company catalogs.